CHAPTER 4

Troubleshooting the System

This chapter contains troubleshooting information. The chapter includes the following sections:

- Using a Cable Modem at the Headend to Verify Downstream Signals
- Managing Cable Modems on the HFC Network
- Polling Cable Modems
- Understanding Show Command Responses
- Troubleshooting Using Cable Flap Lists
- Performing Amplitude Averaging
- Setting Downstream Test Signals
- Pinging Unresponsive Cable Modems
- Using Cable Interface Debug Commands
- Managing the Cisco uBR7246 VXR Clock Card

Using a Cable Modem at the Headend to Verify Downstream Signals

You can use a Cisco uBR924 cable access router to verify the downstream signal originating from a Cisco uBR7200 series universal broadband router. Be sure you configure the Cisco uBR924 according to DOCSIS cable modem practises. To verify the downstream signal from a Cisco uBR7200 series universal router using a Cisco uBR924, follow the procedure below:

Step 1 After the Cisco uBR924 is operational and you have an input signal between 0 and +5 dBmV, enter the **show controller c0 tuner** command.

Step 2 Scan the output for the value corresponding to the signal to noise (SNR) estimate variable. If this value is at least 35 dB, then you have an optimized signal. If the value is less than 34 dB, adjust the upconverter at the cable headend.

Tips The SNR estimate for a cable modem installed at a headend should be between 35 dB and 39 dB. Although the exact value displayed will vary from cable modem to cable modem, values collected on the same cable modem from measurement to measurement will be consistent. Maximizing SNR optimizes cable modem reliability and service quality.

Managing Cable Modems on the HFC Network

To manage cable modems connected to the network, perform the following as appropriate:

- Configure Sync Message Interval
- Activate Cable Modem Authentication
- Activate Cable Modem Upstream Address Verification
- Configure Dynamic Contention Algorithms (Cable Insertion Interval, Range, and Data Backoffs)
- Configure the Dynamic Map Advance Algorithm
- Configure Per Modem Filters
- Configure the Maximum Number of Hosts Attached to a Cable Modem
- Configure Cable Modem Registration Timeout
- Clear Cable Modem Reset
- Clear Cable Modem Counters
- Configure Traffic Shaping
- Configure Spectrum Management (without the Cisco MC16S Cable Modem Card)

Caution Cisco recommends using default values for most commands. Default settings are adequate for most systems.

Configure Sync Message Interval

To specify the interval between successive sync message transmissions from the Cisco uBR7200 series, use the following command in cable interface configuration mode.

Table 4-1 Instructions to Configure Sync Message Interval

Command	Purpose
`CMTS01(config-if)#`**`cable sync-interval`** *`msec`*	Specify the interval in milliseconds between successive sync message transmissions from the Cisco uBR7200 series. Valid values are from 1 to 200 msec. Default = 10 msec.
`no cable sync-interval`	Return the sync message interval to its default value of 10 msec.

Verify Sync Message Interval

To verify whether or not a sync message interval is configured, enter the **show running-config** command and look for the cable interface configuration information. If the sync message interval is deactivated or reset to its default value, the `no sync interval` command line appears in the output.

Activate Cable Modem Authentication

The Cisco uBR7200 series can be configured to require all cable modems to return a known text string to register with the CMTS and gain access to the network. The text string can be from 1 to 80 characters in length. To activate cable modem authentication, use the following command from cable interface configuration mode.

Table 4-2 Instructions to Activate Cable Modem Authentication

Command	Purpose
`CMTS01(config-if)# cable shared-secret` *[0|7]* `authorization-key`	Enable cable modem authentication: **0** specifies an unencrypted authentication key; **7** specifies an encrypted authentication key.
`CMTS01(config-if)# no cable shared-secret`	Disable cable modem authentication.

Tips Be sure you enter the correct slot and port number in the cable interface configuration mode. Verify that the cable modem is using BPI and that it is assigned to a QoS with privacy active. Verify that the cable modem configuration file contains a matching key.

Verify Cable Modem Authentication

To verify whether cable modem authentication is activated or deactivated, enter the command **more system:running-config** and look for the cable interface configuration information. If cable modem authentication is deactivated, it appears in this output as `no cable secret-shared`.

Activate Cable Modem Upstream Address Verification

Cable modem upstream address verification ensures that only cable modems that have received DHCP leases through the Cisco uBR7200 series can access the HFC network. The Cisco uBR7200 series discards all packets received from or for hosts that have not received DHCP-assigned addresses.

To activate cable modem upstream address verification, use the following cable interface configuration command.

Table 4-3 Instructions to Activate Cable Modem Upstream Address Verification

Command	Purpose
`CMTS01(config-if)# cable source-verify [dhcp]`	Activate cable modem upstream verification. The *dhcp* option specifies that queries be sent to verify unknown IP addresses in upstream data packets.
`CMTS01(config-if)# no cable source-verify`	Return to the default upstream verification state.

Verify Cable Modem Upstream Address Verification

To verify whether cable modem upstream verification is activated or deactivated, enter the command **more system:running-config** and look for the `no cable source-verify` notation in the cable interface configuration information.

Tips Be sure you enter the correct slot and port number when you enter the cable interface configuration mode.

Note If the Cisco uBR7200 series is reloaded or the ARP table is cleared, all hosts on the network will be forced to release and renew their IP addresses. Some systems may require restarting if the IP protocol stack is unable to renew using a broadcast IP address.

Configure Dynamic Contention Algorithms (Cable Insertion Interval, Range, and Data Backoffs)

The Cisco uBR7200 series universal broadband router software includes:

- An algorithm that dynamically controls the rate of upstream contention slots —initial ranging and bandwidth-requests.
- An algorithm that varies backoff parameters CMs use within each of the initial ranging and bandwidth-request upstream contention subchannels.

These algorithms control the capacity of the contention subchannel and how efficiently a given contention subchannel capacity is utilized.

In high contention mode, the Cisco uBR7200 series MAC scheduler uses collision statistics and sustains a high frequency of initial ranging slots until it detects a steady ranging state. The CMTS dynamically varies the frequency of initial ranging slots using the data grant utilization on the upstream channel(s). The CMTS trades upstream bandwidth between data grants and initial ranging slots. The CMTS auto-detects a high collision state and switches to low insertion interval mode after a steady state is achieved where few collisions occur.

The CMTS is careful when monitoring the ranging channel health to revert to a steady state. In steady state mode, data grants—grant utilization—receive preference over initial ranging slots.

Although the binary exponential backoff algorithm operates in a distributed fashion at different CMs, the CMTS provides centralized control for the backoff algorithm. To achieve this, it remotely monitors traffic load—the backlog developing on the contention channel—and then varies the backoff start and end specified in the MAPs for that upstream channel. This ensures colliding CMs are properly randomized in time.

The following cable interface commands are available to configure the dynamic contention algorithms:

```
[no] cable insertion-interval [automatic [<Imin [Imax]>]] |  [<msecs>]
[no] cable upstream <port num> range-backoff [automatic] | [<start> <end>]
[no] cable upstream <port num> data-backoff [automatic] | [<start> <end>]
```

Tips System defaults are to have dynamic ranging interval enabled, dynamic ranging backoff enabled, and fixed data backoffs for each upstream of a cable interface.

The default *automatic* insertion interval setting enables the Cisco automatic initial ranging period algorithm where lower and upper default values of 50 msecs and 2 secs are used. The default *automatic* range-backoff enables the dynamic backoff algorithm.

To deviate from system defaults, use one of the following commands in cable interface configuration mode.

Table 4-4 Instructions to Modify Dynamic Contention Algorithm Defaults

Command	Purpose
`CMTS01(config-if)# [no] cable insertion-interval automatic`	Disable or enable the dynamic ranging interval algorithm. If lower and upper bounds for varying the period are not specified, the system uses default values of 50 msecs and 2 secs respectively.
`CMTS01(config-if)# cable insertion-interval automatic min <25-2000>`	Set the lower bound on the initial ranging period for the auto ranging algorithm.
`CMTS01(config-if)# cable insertion-interval max <500-2000>`	Set the upper bound on initial ranging period for the auto ranging algorithm.
`CMTS01(config-if)# no cable insertion-interval`	Reset fixed initial ranging period to default value of 500 msecs. Also invokes fixed initial ranging algorithm.
`CMTS01(config-if)# cable insertion-interval <100-2000>`	Enabled fixed initial ranging period algorithm with specified fixed period (msecs).

Configure the Dynamic Map Advance Algorithm

A CMTS administrator can enhance the upstream throughput from a cable modem connected to the Cisco uBR7200 series. The system employs a new algorithm that auto tunes the lookahead time in MAPs based on several input parameters for the corresponding upstream channel. The use of dynamic/optimal lookahead time in MAPs significantly improves the per-modem upstream throughput.

Caution Only a trained CMTS administrator should adjust these values.

To configure the dynamic map advance algorithm, use the following command in cable interface configuration mode.

Table 4-5 Instructions to Configure the Dynamic Map Advance Algorithm

Command	Purpose
`CMTS01(config-if)#cable map-advance dynamic [<n>] | static`	Specify a value to enhance the upstream throughput from a cable modem connected to the Cisco uBR7200 series. The <*n*> parameter provides the safety factor for the dynamic map advance algorithm. This parameter is specified in usecs and controls the amount of extra lookahead time in MAPs to account for inaccuracies of the measurement system and software latencies. The default value is 1000 usecs. You can vary this between 500 to 1500 usecs. This parameter is a delta value added to the dynamic map-advance that the algorithm computes. Using larger safety factors increases the run time lookahead in MAPs, but reduces the upstream performance. Use the *static* keyword for the map advance command. The Cisco uBR7200 series will use a fixed lookahead time in MAPs, regardless of the real propagation delay of the farthest cable modem on the network. This fixed lookahead time is computed based on the worst case parameters such as farthest DOCSIS propagation delay for the CMs.

Caution Cisco recommends if you are adjusting the dynamic map advance algorithm that you do not reduce the safety factor below the default value of 1000 usecs in a production network until you are confident that the reduced safety factor suffices for your deployment. The default value is chosen to be a safe operating point for the algorithm.

Configure Per Modem Filters

You can configure the Cisco uBR7200 series to filter incoming packets from individual hosts or cable modems based on the source Media Access Controller (MAC) or Internet Protocol (IP) address. Definition of filters follows standard Cisco IOS configuration practices for access lists and groups.

Note Configuring per modem or host filters is supported in Cisco IOS Release 12.0(5)T1 or higher, as well as in Cisco IOS Release 12.0(6)SC or higher.

To configure per modem filters, use the following commands in cable interface configuration mode.

Table 4-6 Instructions to Configure Per Modem Filters

Command	Purpose
`CMTS01(config-if)# cable {modem | host | device} {<macaddr><ipaddr> | } access group <acl>`	Configure access lists to be specified on a per-interface and per-direction basis. The packets received from cable modems and/or individual hosts are filtered based on the cable modem or the host the packets are received from. Use *modem* if the device is a cable modem. Use *host* if the device is a CPE device attached to a cable modem. Define the filter to be applied to the device and a given address. The *macaddr* specifies the cable modem's or CPE device's unique MAC address. Use the *ipaddr* option to specify the CM or CPE device's current IP address. Use the *acl* option to assign the CM or CPE device to an access list. This defines the per-CM or per-host filter requirements implemented at the CMTS, rather than at the CM. Access list numbers are 1 to 99 for fast IP access lists, 100 to 199 for show extended IP access lists. **Note** Access list numbers of 700 to 799 do not apply.

Caution The system applies filters after the cable modem registers with the CMTS. Filter definitions are not saved across system reboots and must be applied each time a CM registers.

The software supports traps to alert CMTS administrators on CMs going offline or back online. A typical registration and login procedure is shown below:

1. The CM registers with the Cisco uBR7200 series.
2. The Cisco uBR7200 series sends traps to management systems in use for the network.
3. The management system sets per modem filters using SNMP or *rsh*.
4. The user logs in at the server.
5. The login server obtains required modem and CPE information from the Cisco uBR7200 series.
6. The login server sets per-CPE filter in the Cisco uBR7200 series. The per-CPE filter overrides the per modem filter settings.
7. If the CM goes offline for a brief period of time, filters defined using the Cisco uBR7200 series remain active. If a CM stays offline for more than 24 hours, filter settings are reset.
8. If the user logs out or the login server detects that the user is not online, the login server sets default filters for the CM or the CPE device.

Configure the Maximum Number of Hosts Attached to a Cable Modem

To specify the maximum number of hosts that can be attached to a subscriber's cable modem, use the following command in cable interface configuration mode.

Table 4-7 Instructions to Configure the Maximum Number of Hosts Attached to a Cable Modem

Command	Purpose
`CMTS01(config-if)# cable max-hosts n`	Specify the maximum number of hosts that can be attached to a cable modem on this interface. Valid range is from 0 to 255 hosts. Default = 0.
`CMTS01(config-if)# no cable max-hosts`	Reset the allowable number of hosts attached to a cable modem to the default value of 0 hosts.

Configure Cable Modem Registration Timeout

By default, registered cable modems that have no upstream activity for three minutes are timed out and disconnected from the Cisco uBR7200 series. This timeout interval can be decreased to 2 minutes or increased up to 60 minutes.

To specify the registration timeout interval for cable modems connected to the Cisco uBR7200 series, use the following command in cable interface configuration mode.

Table 4-8 Instructions to Configure Cable Modem Registration Timeout

Command	Purpose
`CMTS01(config-if)# cable registration-timeout n`	Specify the maximum number of minutes allowed to elapse with no upstream activity before terminating the connection. Valid range is from 2 to 60 minutes. Default = 3 minutes.

Clear Cable Modem Reset

To remove a single cable modem (or all cable modems) from the station maintenance list and reset the cable modem (or all cable modems) on the network, use one of the following commands in cable interface configuration mode.

Table 4-9 Instructions to Clear Cable Modem Reset

Command	Purpose
`CMTS01(config-if)# clear cable modem mac-addr reset`	Remove the cable modem with a specific MAC address from the station maintenance list and reset it.
`CMTS01(config-if)# clear cable modem ip-addr reset`	Remove the cable modem with a specific IP address from the station maintenance list and reset it.
`CMTS01(config-if)# clear cable modem all reset`	Remove all cable modems from the station maintenance list and reset them.

Verify Clear Cable Modem Reset

To verify whether or not the **clear cable modem reset** command has removed a cable modem from the station maintenance list and forced it to start a reset sequence, enter the **show cable modem** command.

Tips Be sure you entered the correct cable modem IP address or MAC address when you typed the command. It might take up to 30 seconds for the cable modem to start the reset sequence.

Note This command is useful if an SNMP manager is not available, or if the cable modem is unable to obtain an IP address or respond to SNMP messages.

Clear Cable Modem Counters

To clear the counters for a cable modem (or for all cable modems) in the station maintenance list, use one of the following commands in cable interface configuration mode.

Table 4-10 Instructions to Clear Cable Modem Counters

Command	Purpose
`CMTS01(config-if)# clear cable modem mac-addr counters`	Clear the counters in the station maintenance list for the cable modem with a specific MAC address.
`CMTS01(config-if)# clear cable modem ip-addr counters`	Clear the counters in the station maintenance list for the cable modem with a specific IP address.
`CMTS01(config-if)# clear cable modem all counters`	Clear the counters in the station maintenance list for all cable modems.

Verify Clear Cable Modem Counters

To verify whether or not the counters in the Station Maintenance List are cleared, enter the **following** command. The station maintenance list counter will be 0.

Configure Traffic Shaping

Configure Downstream Rate Limiting and Shaping

To configure downstream rate limiting or shape downstream traffic, use the following command in cable interface configuration mode.

Table 4-11 Instructions to Configure Downstream Shaping

Command	Purpose
`CMTS01(config-if)#`*`[no]`* **`cable downstream rate-limit token-bucket`** *`[shaping]`* **`weighted-discard`** *`[expwt <n>]`*	Enables or disables rate limiting and traffic shaping on the downstream of a cable interface.

Note Using Cisco IOS Release 12.0(5)T1 or higher, the software adds downstream calendar queuing routines and grant shaping application of the calendar queues.

Key command usage is elaborated below:

- To enable rate limiting on the given downstream port using the token bucket policing algorithm, issue the **cable downstream rate-limit token-bucket** command.
- To enable rate limiting on the given downstream port using the token bucket policing algorithm with traffic shaping, issue the **cable downstream rate-limit token-bucket shaping** command.
- To enable rate limiting on the given downstream port using the token bucket policing algorithm with a specific traffic shaping time granularity, issue the **cable downstream rate-limit token-bucket shaping granularity 8** command. Acceptable values are 1, 2, 4, 8, or 16 msecs.
- To enable rate limiting on the given downstream port using the token bucket policing algorithm with a specific maximum traffic shaping buffering delay, issue the **cable downstream rate-limit token-bucket shaping granularity 8** command. Acceptable values are 128, 256, 512, or 1028 msecs.
- To remove rate limiting on the given downstream port, issue the **cable downstream rate-limit token-bucket** command.
- To enable rate limiting on the given downstream port using a weighted packet discard policing algorithm and to assign a weight for the exponential moving average of loss rate value, issue the **cable downstream rate-limit weighted-discard 3** command. Acceptable values are 1 to 4.

Configure Upstream Rate Limiting and Shaping

You can rate limit and shape traffic on a DOCSIS upstream channel. This delays the scheduling of the upstream packet, which in turn causes the packet to be buffered on the cable CPE device, instead of being dropped. This allows the user's TCP/IP stack to pace the application traffic appropriately and approach throughput commensurate with the subscriber's defined QoS levels.

To configure this, use the following command in cable interface configuration mode.

Table 4-12 Instructions to Configure Upstream Shaping

Command	Purpose
CMTS01(config-if)#*[no]* **cable upstream** *<n1>* **rate-limit [token-bucket]**	Enables or disables DOCSIS rate limiting or shaping on an upstream channel. <n1> depends on the number of upstream channels on the specific cable modem card.

Using Cisco IOS Release 12.0(5)T1 or higher, the software supports:

- Generic calendar queuing routines
- New token bucket policing function
- Grant shaping application of the calendar queues
- Upstream rate shaping option to the token-bucket keyword
- A default state change from 1 second burst policing to token-bucket with shaping

Tips Upstream grant shaping is per CM (SID). Shaping can be enabled or disabled for the token-bucket algorithm.

Note Before the introduction of this feature, the CMTS would drop bandwidth requests from a CM it detected as exceeding its configured peak upstream rate. Such request dropping affects the throughput performance of IP-based protocols such as FTP, TCP, and SMTP. With this feature, the CMTS can shape (buffer) the grants for a CM that is exceeding its upstream rate, rather than dropping the bandwidth requests.

```
CMTS01# show interface c3/0 sid 1 counters
Sid   Inpackets  Inoctets   Outpackets Outoctets  Ratelimit  Ratelimit
                                                  BWReqDrop  DSPktDrop
1     67859      99158800   67570      98734862   2579       0
```

Configure Spectrum Management (without the Cisco MC16S Cable Modem Card)

Blind Strategies and Time Scheduled Combined

The Cisco uBR7200 series software supports combined blind and time scheduled spectrum management using Cisco IOS Release 12.0(5)T1 images or higher:

- Using blind spectrum management, the number of lost station management messages exceeding a configured threshold (default = 10) initiates an upstream channel frequency reassignment. The Cisco uBR7200 series moves all cable modems on the upstream port by sending UCD messages that contain the next frequency and input power level defined in the spectrum management group. The frequency change occurs rapidly without data loss and minimal latency.

- Using time scheduled spectrum management, the upstream channel frequency reassignment process is initiated at a configured time of day or week.

With combined blind and time scheduled strategies, blind hop tables are given time-variant configurability. The frequency or subband list can change with time. Blind frequency hop is performed within the spectrum specified to be currently available. An example follows:

```
uBR(config)# cable spectrum-group 2 time Mon 09:00:00 frequency 10000000
uBR(config)# cable spectrum-group 2 time Tue 09:05:00 delete frequency 10000000
uBR(config)# cable spectrum-group 2 time Tue 09:00:00 frequency 5000000
uBR(config)# cable spectrum-group 4 time Fri 09:00:00 band 15000000 25000000
uBR(config)# cable spectrum-group 4 time Sat 09:00:00 delete band 15000000 25000000
```

Guided Frequency Hop

Using guided frequency hop, the upstream channel frequency is reassigned if a threshold number or percentage of cable modems suddenly go offline. You can adjust the thresholds and assign explicit frequencies or frequency subbands and associated input power levels in the unified spectrum group table. The Cisco uBR7200 series locates the defined channel or a suitable channel and moves all cable modems on the upstream port.

The example below shows the Cisco uBR7200 series' ability to force the CTMS to change the upstream to another frequency before the CMTS sends a message to increase output power levels. You can configure the frequency hop table so that the next entry has the same frequency, but a different power level:

```
uBR(config)# cable spectrum-group 2 frequency 20000000
uBR(config)# cable spectrum-group 2 frequency 20000000 2
uBR(config)# cable spectrum-group 2 frequency 20000000 -2
uBR(config)# cable spectrum-group 2 frequency 22000000
uBR(config)# cable spectrum-group 2 frequency 22000000 2
uBR(config)# cable spectrum-group 2 frequency 22000000 3
```

The order of the configuration commands defines the order which frequency or power level is changed. There is always a single allocation set per-spectrum group, listing the currently available bands. In the case of a shared spectrum group, there is also a single free set and "in-use" set since there is a single RF domain. Otherwise, there are free and in-use sets for each upstream port since each upstream port has its own RF domain.

Sample output:

```
noisy1#show cable spec
Group  Frequency      Upstream     Weekly Scheduled            Power   Shared
No.    Band           Port         Availability                Level   Spectrum
       (Mhz)                       From Time:   To Time:       (dBmV)

1      10.000- 0.000                                           1       No
1      11.000- 0.000                                           1       No
1      12.000- 0.000                                           1       No
1      13.000- 0.000                                           1       No
1      14.000- 0.000                                           1       No
2      10.000-15.000                                           2       No
2      10.208 [0.40]  Cable3/0 U1                              2
3      20.000- 0.000                                           3       Yes
3      21.000- 0.000                                           3       Yes
3      22.000- 0.000                                           3       Yes
3      23.000- 0.000                                           3       Yes
3      24.000- 0.000                                           3       Yes
3       0.400 [0.80]  Cable3/0 U2                              3
4      20.000-25.000                                           4       Yes
4      20.800 [1.60]  Cable3/0 U3                              4
5      10.000- 0.000                                           5       No
5      11.000- 0.000                                           5       No
5      12.000- 0.000                                           5       No
5      13.000- 0.000              Mon 17:06:00  --- --:--:--  5       No
5      14.000- 0.000              Mon 17:08:00  --- --:--:--  5       No
5      13.000- 0.000              Mon 17:10:00  --- --:--:--  5       No
5       1.600 [3.20]  Cable3/0 U4                              5
6      10.000-13.000                                           6       No
6      13.000-15.000              Mon 17:11:00  Mon 17:12:00  6       No
6      10.800 [1.60]  Cable3/0 U5                              0
```

To display information about a specific interface or upstream port, enter the following command:**show cable hop** *cable-if* [**upstream** *portnum*]. Information lines describe the frequency hop status of an upstream port.

Table 4-13 Show Cable Hop Parameter Descriptions

Field	Description
Upstream Port	The upstream port for this information line
Port Status	Show “down” if frequency is unassigned, “admindown” if the port is shutdown, or the center frequency of the channel if the port is up
Poll Rate	The rate station maintenance polls are generated (msec)
Missed Poll Count	The number of missing polls
Min Poll Sample	The number of polls in the sample
Missed Poll Pcnt	The ratio of missing polls to the number of polls displayed as a percentage
Hop Thres Pcnt	The level that the missed poll percentage must exceed to trigger a frequency hop expressed as a percentage
Hop Period	The maximum rate which frequency hopping will occur (seconds)
Corr FEC Errors	The number of correctable FEC errors on this upstream port
Uncorr FEC Errors	The number of uncorrectable FEC errors on this upstream port

Sample output:

```
noisy1#show cable hop
Upstream    Port       Poll Missed Min    Missed Hop   Hop     Corr    Uncorr
Port        Status     Rate Poll   Poll   Poll   Thres Period  FEC     FEC
                       (ms) Count  Sample Pcnt   Pcnt  (sec)   Errors  Errors
Cable3/0/U0 down       1000 * * *   frequency not set    * * * 0       0
Cable3/0/U1 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U2 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U3 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U4 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U5 admindown  1000 * * *   interface is down    * * * 0       0
Cable4/0/U0 10.800 Mhz 1000 0      0       -----  100%  300    0       0
Cable6/0/U0 down       1000 * * *   frequency not set    * * * 0       0
```

Spectrum Management Debug and Test Commands

To enable display of frequency hopping debugging messages, enter:

debug cable freqhop

To enable display of spectrum management debugging messages, enter:

debug cable specmgmt

This command also enables display of channel width list and offer list for the **show cable spectrum-group** command.

To force a frequency hop decision on the port or ports, enter:

test cable hop *cable-if* [*upstream portnum*]

Show Cable Hop Command

Using Cisco IOS Release 12.0(5)T1 or higher headend images, you can use the following command to obtain specific upstream interface information:

show cable hop *cable-if* [**upstream** <*portnum*>]

Table 4-14 Show Cable Hop Parameter Descriptions

Field	Description
Upstream Port	The upstream port for this information line
Port Status	Show “down” if frequency is unassigned, “admindown” if the port is shutdown, or the center frequency of the channel if the port is up
Poll Rate	The rate station maintenance polls are generated (msec)
Missed Poll Count	The number of missing polls
Min Poll Sample	The number of polls in the sample
Missed Poll Pcnt	The ratio of missing polls to the number of polls expressed as a percentage
Hop Thres Pcnt	The level that the missed poll percentage must exceed to trigger a frequency hop expressed as a percentage
Hop Period	The maximum rate which frequency hopping will occur (seconds)
Corr FEC Errors	The number of correctable FEC errors on this upstream port
Uncorr FEC Errors	The number of uncorrectable FEC errors on this upstream port

```
noisy1#show cable hop
Upstream    Port       Poll Missed Min    Missed Hop   Hop     Corr    Uncorr
Port        Status     Rate Poll   Poll   Poll   Thres Period  FEC     FEC
                       (ms) Count  Sample Pcnt   Pcnt  (sec)   Errors  Errors
Cable3/0/U0 down       1000 * * *   frequency not set    * * * 0       0
Cable3/0/U1 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U2 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U3 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U4 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U5 admindown  1000 * * *   interface is down    * * * 0       0
Cable4/0/U0 10.800 Mhz 1000 0      0       -----  100%  300    0       0
Cable6/0/U0 down       1000 * * *   frequency not set    * * * 0       0
```

Using Cisco IOS Release 12.0(5)T1 or higher headend images, you can use the following command to obtain specific upstream interface information:

show cable hop *cable-if* [**upstream** <*portnum*>]

Table 4-15 Upstream Port Parameter Descriptions

Field	Description
Upstream Port	The upstream port for this information line
Port Status	Show “down” if frequency is unassigned, “admindown” if the port is shutdown, or the center frequency of the channel if the port is up
Poll Rate	The rate station maintenance polls are generated (msec)
Missed Poll Count	The number of missing polls
Min Poll Sample	The number of polls in the sample
Missed Poll Pcnt	The ratio of missing polls to the number of polls expressed as a percentage
Hop Thres Pcnt	The level that the missed poll percentage must exceed to trigger a frequency hop expressed as a percentage
Hop Period	The maximum rate at which frequency hopping will occur (seconds)

Table 4-15 Upstream Port Parameter Descriptions (continued)

Field	Description
Corr FEC Errors	The number of correctable FEC errors on this upstream port
Uncorr FEC Errors	The number of uncorrectable FEC errors on this upstream port

Sample output:

```
noisy1#show cable hop
Upstream    Port       Poll Missed Min    Missed Hop   Hop     Corr    Uncorr
Port        Status     Rate Poll   Poll   Poll   Thres Period  FEC     FEC
                       (ms) Count  Sample Pcnt   Pcnt  (sec)   Errors  Errors
Cable3/0/U0 down       1000 * * *   frequency not set    * * * 0       0
Cable3/0/U1 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U2 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U3 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U4 admindown  1000 * * *   interface is down    * * * 0       0
Cable3/0/U5 admindown  1000 * * *   interface is down    * * * 0       0
Cable4/0/U0 10.800 Mhz 1000 0      0       -----  100%  300    0       0
Cable6/0/U0 down       1000 * * *   frequency not set    * * * 0       0
```

Debug and Test Commands

To enable display of frequency hopping debugging messages, enter:

debug cable freqhop

To enable display of spectrum management debugging messages, enter:

debug cable specmgmt

To force a frequency hop decision on the port or ports, enter:

test cable hop *cable-if* I *portnum*

Polling Cable Modems

Cisco IOS Release 12.0(7)XR2, Cisco IOS Release 12.1(1a)T1 or higher CMTS images, contain modem status enhancements. You can obtain operating statistics and determine the state of cable modems on the network.

The Cisco uBR7200 series supports polling of cable modems to obtain parameter and status information on an ongoing basis. Two new Cisco IOS commands are added to support the feature:

- The **cable modem remote** command configures the router for the polling interval; the **no** version of this command disables the status polling.
- The **show cable modem remote-query** command displays the collected information: downstream receive power level, downstream signal to noise ratio, upstream power level, micro reflection in dB.

The Cisco uBR7200 series polls cable modems on the network and caches the state information on the CMTS, allowing administrators to use SNMP to manage the system.

This section describes how you can enable this. See the following configuration tasks:

- Enable SNMP (required)
- Configure Remote Modem Monitoring (required)

Enable SNMP

Command	Purpose
`Router(config)# snmp-server manager`	Opens the SNMP manager
`Router(config)# snmp-server community [Community String] [Permissions]`	Defines user permissions

Configure Remote Modem Monitoring

Command	Purpose
`Router(config)# cable modem remote-query [polling interval] [Community string]`	Specifies how often SNMP polls the modem and allows you to configure access

Verifying Remote Query Information

To display information from a queried modem, enter the **show cable modem remote-query** command.

```
R7732-01-uBR7246#sh cable modem remote-query
IP address      MAC address     S/N    US     DS    Tx Time Micro (dB) Modem
                                Ratio  Power  Power Offset  Reflection State
5.108.1.2       0010.4bd7.ccf2   0.0    0.0    0.0  0       0  offline
5.109.1.2       0000.0000.0022   0.0    0.0    0.0  0       0  offline
5.110.1.2       0000.0000.0023   0.0    0.0    0.0  0       0  offline
5.108.1.5       0000.0000.0026   0.0    0.0    0.0  0       0  offline
5.108.1.4       0000.0000.0024   0.0    0.0    0.0  0       0  offline
5.108.1.3       0000.0000.0025   0.0    0.0    0.0  0       0  offline
```

Tips To display debugging information, enter the **debug cable remote-query** command.

See the following for an example debug message of a successful poll of a cable modem:

```
router# debug cable remote-query
remote-query debugging is on
.
For IP address 209.165.200.223
Nov 10 15:56:50.241: docsIfSignalQualityEntry.5.4 = 380
Nov 10 15:56:50.241: docsIfMibObjects.2.2.1.3.2 = 360
Nov 10 15:56:50.245: docsIfDownstreamChannelEntry.6.4 = -30
Nov 10 15:56:50.245: docsIfUpstreamChannelEntry.6.3 = 12422
Nov 10 15:56:50.249: docsIfSignalQualityEntry.6.4 = 0
Nov 10 15:56:50.477:
```

See the following for an example debug message when the waiting queue at the CMTS is empty:

```
SNMP proxy exec got event, but queue is empty
```

See the following for an example debug message when you try to modify the polling interval or community string while polling in is progress:

```
Community string if modified will not be reflected
```

Note The polling interval will be changed. To change the community string, you must unconfigure the **snmp-server community** command and reconfigure it with the new community string.

Monitoring and Maintaining Remote Querying

Use the following show commands to gather status information about the specified modems.

Command	Purpose
Router# **show cable flap-list**	Displays statistics on the quality of the modem connection.
Router# **show cable modem**	Displays statistics on modem states.
Router# **show cable modem remote-query**	Displays statistics gathered by SNMP agents on modem states.
Router# **show interface cable**	Displays statistics on the quality of the cable interface.
Router# **show interface cable sid**	Displays statistics on the service IDs of the specified modems.

Understanding Show Command Responses

General Show Commands

Key show commands include:

- **show cable modem**
- **show interface cable**
- **show cable qos profile**
- **show cable modulation profile**
- **show cable spectrum-group**

Additional or changed show commands using Cisco IOS Release 12.0(7)XR2, Cisco IOS Release 12.1(1a)T1, or higher CMTS images include the following:

- The **show cable qos** command shows **cable qos-profile** *n* command, where the optional argument *n* can be used to display a specific profile.
- The **show int cx/y sid** command displays more complete Service ID (SID) status information.
- The **show cable modem** command displays a list of options for a single modem to be specified by entering either the RF CPE device's IP address or MAC address: SNR information for each cable modem on each interface, summary display of the total number of modems connected for each upstream channel, total number of registered and unregistered modems for the specified interface or upstream, total number of offline modems for the specified interface or upstream and status for each offline modem before it went offline.
- The **show cable burst-profile** command has been removed. Its functions have been incorporated into the **show cable modulation-profile** command, which now includes an added option number that displays the modulation profile number.

- The **show cable flap-list** and **show cable modem** commands now indicate when the Cisco uBR7200 series router has detected an unstable return path for a particular modem and has compensated with a power adjustment. An asterisk appears in the power adjustment field for a modem when a power adjustment has been made; an exclamation point appears when the modem has reached its maximum power transmit level and cannot increase its power level any further.
- The **show controller upstream** command is enhanced to display the following information on cable interfaces:
  - Upstream channel utilization in minislots
  - Contention slots
  - Initial ranging slots
  - Minislots lost due to the MAP interrupt being too late.

  You can also limit your search for modem status to specific cable interfaces.

Show Cable Modem

Using Cisco IOS Release 12.0(7)XR2, Cisco IOS Release 12.1(1a)T1 or higher, the **show cable modem** command includes all DOCSIS states, as well as other useful troubleshooting information such as last received upstream RF power level and maximum number of provisioned customer premises equipment.

Note DOCSIS cable modems are required to pass through successive states during registration and provisioning. Using this information, you can isolate why a cable modem is offline or unavailable.

Specific added information includes the downstream receive power ratio, downstream SNR, upstream and downstream power levels, transmit timing offset, and micro reflections in decibels.

For each upstream channel, you can obtain the following information:

- The total number of modems
- The number of active modems
- The number of registered modems
- The number of unregistered modems
- The number of offline modems.
- The time the modem went offline
- The status before the modem went offline
- The receive power before the modem went offline.

See the sample command output below:

```
router# show cable modem
 Interface   Prim Online     Timing Rec    QoS CPE IP address      MAC address
             Sid  State      Offset Power
 Cable3/0/U0 1    online     2257    0.00  3   0   10.30.128.142   0090.8330.0217
 Cable3/0/U0 2    online     2262  *-0.50  3   0   10.30.128.145   0090.8330.020f
 Cable3/0/U0 3    online     2260    0.25  3   0   10.30.128.146   0090.8330.0211
 Cable3/0/U0 4    online     2256   *0.75  3   0   10.30.128.143   0090.8330.0216
 Cable3/0/U0 5    online     2265   *0.50  3   0   10.30.128.140   0090.8330.0214
 Cable3/0/U0 6    online     2256    0.00  3   0   10.30.128.141   0090.8330.0215
 Cable3/0/U0 7    online     4138  !-1.00  3   1   10.30.128.182   0050.7366.124d
 Cable3/0/U0 8    online     4142  !-3.25  3   1   10.30.128.164   0050.7366.1245
 Cable3/0/U0 9    online     4141  !-3.00  3   1   10.30.128.185   0050.7366.17e3
 Cable3/0/U0 10   online     4142  !-2.75  3   0   10.30.128.181   0050.7366.17ab
 Cable3/0/U0 11   online     4142  !-3.25  3   1   10.30.128.169   0050.7366.17ef
```

The **show cable modem** indicates when the Cisco uBR7200 series router has detected an unstable return path for a particular CM and has compensated with a power adjustment. An asterisk appears in the power adjustment field for a CM when a power adjustment has been made; an exclamation point appears when the CM has reached its maximum power transmit level and cannot increase its power level any further.

Columns are described below:

- The prim Sid column reveals the primary (lifeline) service identifier assigned to the cable modem.
- The SID column is the service identifier.
- The Online State column reveals the state of the modem; values include:
  - offline—Cable modem considered offline
  - offline time—the time the cable modem went offline; the format is the same as other show cable modem commands (month, day, time, and year)
  - init (r1)—Cable modem sent initial ranging
  - init (r2)—Cable modem is ranging
  - init (rc)—Cable modem ranging complete
  - init (d)—Dhcp request received
  - init (i)—Dhcp reply received; IP address assigned
  - init (o)—Option file transfer started
  - init (t)—TOD exchange started
  - online—Cable modem registered, enabled for data
  - online(d)—Cable modem registered, but network access for the cable modem is disabled
  - online(pk)—Cable modem registered, BPI enabled and KEK assigned
  - online(pt)—Cable modem registered, BPI enabled and TEK assigned
  - reject (m)—Cable modem did attempt to register; registration was refused due to bad MIC
  - reject (c)—Cable modem did attempt to register; registration was refused due to bad COS
  - reject (pk)—KEK modem key assignment rejected
  - reject (pt)—TEK modem key assignment rejected
- The Rec Power column contains the nominal receive power in decibels for this SID

Note * means the noise power adjustment method is active for this modem; ! means the modem has reached its maximum transmit power

- The QoS column contains the service class assigned to the modem
- The CPE column identifies the number of devices behind the modem
- The Max CPE column identifies the maximum number of devices configured for the modem
- The IP address reveals the modem's IP address
- The MAC address reveals the modem's MAC address
- The Concatenation column reveals if concatenation is enabled (yes) or disabled (no)
- The Rx SNR column reveals the SNR ratio level in dBmV as perceived by the cable modem

Note This parameter is only meaningful for cable modems. A CMTS will return a zero.

- The S/N Ratio column provides values for remote-queried modems.
- The US Power column reveals the transmit power level for the upstream channel in dBmV.
- The DS Power column reveals the received power level at the downstream modem in dBmV.

Note If the power level measurement is not supported, set this parameter to zero. Also, if the interface is down, this value will be the CMTS-configured value, the most current CM value, or zero.

- The Tx Timing Offset shows the current round trip time at the CM. The value is used to synchronize upstream transmission to the CMTS and is measured in units of 6.25 microseconds.
- The Micro (dB) Reflection column is the total microreflections including in-channel response as perceived on this interface, measured in Dbc below the signal level.

Note The value is not assumed to return an absolutely accurate value, but gives a rough indication of microreflections received on this interface.

- The Offline Time column reveals when a modem went offline.
- The Previous State column reveals the modem's status prior to going offline. See the modem ranging states given earlier.
- The Rx Power column reveals the last receive power measurement for a modem that is offline before it went offline.
- SM Exhaust Count reveals the number of times the CMTS declared that modem offline. The modem can be marked offline for various reasons. Refer to Show Cable Modem Maintenance, page 4-23.

See the following sample for detailed output of the **show cable modem** command:

```
router#show cable modem detail
Interface   SID  MAC address    Max CPE  Concatenation Rx SNR
Cable3/0/U0 1    0090.8330.0215 3        yes
Cable3/0/U0 2    0090.8330.0213 3        yes
Cable3/0/U0 3    0090.8330.0214 3        yes
Cable3/0/U0 4    0090.8330.0217 3        yes
Cable3/0/U0 5    0090.8330.020f 3        yes
Cable3/0/U0 6    0050.7366.17e3 3        no
Cable3/0/U0 7    0090.8330.0211 3        yes
Cable3/0/U0 8    0050.7366.17af 3        no
Cable3/0/U0 9    0090.8330.0216 3        yes
Cable3/0/U0 10   0050.7366.1801 3        no
Cable3/0/U0 11   0050.7366.124d 3        no
Cable3/0/U0 12   0050.7366.1241 3        no
Cable3/0/U0 13   0050.7366.17db 3        no
Cable3/0/U0 14   0050.7366.1239 3        no
Cable3/0/U0 15   0050.7366.17ab 3        no
Cable4/0/U0 1    0050.7366.1db1 3        no             26.50
Cable4/0/U1 2    0050.7318.e97f 3        no             23.87
Cable4/0/U1 3    0050.7318.e965 3        no             23.85
Cable4/0/U0 4    0050.7318.e931 3        no             26.72
Cable4/0/U1 5    0050.7318.e92d 3        no             23.31
Cable4/0/U1 6    0050.7318.e97b 3        no             23.85
Cable4/0/U0 7    0050.7366.1d8d 3        no             26.88
Cable4/0/U0 8    0050.7318.e953 3        no             26.54
Cable4/0/U1 9    0050.7366.1d9d 3        no             23.72
Cable4/0/U1 10   0050.7318.e96b 3        no             23.79
Cable4/0/U1 11   0050.7366.1d95 3        no             23.82
Cable4/0/U0 12   0050.7318.e93f 3        no             26.26
Cable4/0/U1 13   0050.7318.e96d 3        no             23.51
Cable4/0/U0 14   0050.7318.e941 3        no             26.69
Cable4/0/U0 15   0050.7366.1dcd 3        no             26.94
Cable4/0/U1 16   0050.7318.e939 3        no             23.98
Cable4/0/U0 17   0050.7366.1d8f 3        no             27.13
Cable4/0/U0 18   0050.7302.3da3 3        no             26.58
Cable4/0/U0 19   0050.7318.e93b 3        no             26.49
Cable4/0/U0 20   0050.7318.e901 3        no             26.68
Cable4/0/U1 21   0050.7366.1dbb 3        no             23.45
Cable4/0/U0 22   0050.7318.e957 3        no             26.35
Cable4/0/U0 23   0050.7318.e985 3        no             26.40
Cable4/0/U0 24   0050.7366.1dbd 3        no             26.69
```

See the following sample output of modems connected on upstream channel 0 for cable interface slot 3, port 0:

```
router#show cable modem cable 3/0 upstream 0
Interface   Prim Online     Timing Rec    QoS CPE IP address        MAC address
            Sid  State      Offset Power
Cable3/0/U0 1    offline    2264   -0.50  2   0   209.165.200.2     0090.8330.0214
Cable3/0/U0 2    offline    4137  !-3.50  2   0   209.165.200.9     0050.7366.17d3
Cable3/0/U0 3    init(d)    4136  !-2.50  2   0   209.165.200.0     0050.7366.17ab
Cable3/0/U0 4    init(d)    4138  !-4.75  2   0   209.165.200.0     0050.7366.1803
Cable3/0/U0 5    init(d)    4137  !-2.25  2   0   209.165.200.0     0050.7366.1801
Cable3/0/U0 6    init(o)    2251   -0.25  2   0   209.165.200.3     0090.8330.0213
Cable3/0/U0 7    offline    2264    0.75  2   0   209.165.200.4     0090.8330.020f
Cable3/0/U0 8    offline    2266   -0.50  2   0   209.165.200.5     0090.8330.0211
Cable3/0/U0 9    init(rc)   4662    1.00  2   0   209.165.200.0     00d0.bad3.c459
```

See the following sample output of unregistered modems connected on upstream channel 0 for cable interface 3, port 0:

```
router#show cable modem cable 3/0 upstream 0 unregistered
Interface   Prim Online     Timing Rec    QoS CPE IP address        MAC address
            Sid  State      Offset Power
Cable3/0/U0 1    offline    2264   -0.50  2   0   209.165.200.2     0090.8330.0214
Cable3/0/U0 2    offline    4137  !-3.50  2   0   209.165.200.9     0050.7366.17d3
Cable3/0/U0 3    init(d)    4136  !-2.75  2   0   209.165.200.0     0050.7366.17ab
Cable3/0/U0 4    init(d)    4137  !-3.25  2   0   209.165.200.0     0050.7366.1803
Cable3/0/U0 5    init(d)    4141  !-2.75  2   0   209.165.200.0     0050.7366.1801
Cable3/0/U0 6    offline    2251   -0.25  2   0   209.165.200.3     0090.8330.0213
Cable3/0/U0 7    offline    2254   -1.00  2   0   209.165.200.4     0090.8330.020f
Cable3/0/U0 8    offline    2248    0.00  2   0   209.165.200.5     0090.8330.0211
Cable3/0/U0 9    init(rc)   4665   -0.50  2   0   209.165.200.0     00d0.bad3.c459
```

See the following sample output of offline modems connected on upstream channel 0 for cable interface 3, port 0:

```
router#show cable modem cable 3/0 upstream 0 offline
Interface   MAC address    Prim Previous  Offline          Rx     Rx    SM
                           Sid  State     Time             Power  SNR   Exhaust
                                                                       Count
Cable3/0/U0 0050.7366.17d3 2    init(o)   Jan 16 20:30:26 !-3.50  ----- 1
Cable3/0/U0 0090.8330.0213 6    init(o)   Jan 16 20:30:55  -0.25  ----- 181
Cable3/0/U0 0090.8330.020f 7    init(o)   Jan 16 20:31:07  -1.00  ----- 181
Cable3/0/U0 0090.8330.0211 8    init(o)   Jan 16 20:31:23   0.00  ----- 181
```

Show Cable Modem Maintenance

When a cable modem is detected to be offline by the CMTS—no reply after 16 retries of station maintenance requests—the cable modem is marked offline. Besides marking the cable modem and SID state offline, the SID is removed immediately from the CMTS ranging list and an aging timer is started to cleanup the SID completely if the cable modem does not attempt to come online within the next 24 hours.

Output fields are described below:

- The "SM Exhausted Count" value refers to the number of times a cable modem was dropped because it did not reply to station maintenance requests. A CM is removed from the station maintenance list after 16 times of periodic ranging opportunity without seeing the RNG_REQ from the modem.
- The "SM Aborted Count" value refers to the number of times the CM was dropped because its operational parameters were unacceptable. This includes such reasons as the power level is outside the acceptable range, or the timing offset keeps changing. The respective times in the command output indicate when this happened.

Following is a response to the **show cable modem maintenance** command using Cisco IOS Release 12.0(5)T1:

```
uBR7200#show cable modem maintenance

Interface    SID   MAC Address       SM Exhausted           SM Aborted
                                    Count       Time       Count      Time
Cable4/0/U1  1     0010.7b6b.5e27    4    Apr 29 19:33:19   0
Cable4/0/U0  2     0010.7b6b.5e15    8    Apr 29 19:34:55   0
Cable4/0/U2  11    0050.731c.b025    1    Apr 29 16:43:39   0
Cable4/0/U0  13    0050.731c.b021    1    Apr 29 15:58:43   0
Cable4/0/U0  16    0050.731c.b009    1    Apr 29 15:58:28   0
Cable4/0/U0  20    0050.731c.bfed    1    Apr 28 14:36:22   0
Cable4/0/U2  24    0050.731c.b023    1    Apr 27 10:30:36   0
Cable4/0/U1  27    0050.731c.bfeb    1    Apr 28 14:54:53   0
Cable4/0/U2  28    0050.731c.bfdf    1    Apr 28 14:50:55   0
Cable4/0/U1  30    0050.7366.1a71    2    Apr 29 17:49:00   0
Cable4/0/U1  31    0050.7366.1bab    3    Apr 29 16:21:47   0
Cable4/0/U1  32    0050.731c.bfe7    0                      2    Jan 1  09:00:00
Cable4/0/U1  33    0050.731c.bfd3    4    Apr 29 15:09:28   0
Cable4/0/U2  35    0050.731c.b041    1    Apr 29 16:17:41   0
Cable4/0/U1  36    0050.7366.1ab9    2    Apr 29 16:53:26   0
```

Show Interface Cable

To display cable interface information, use the **show interface cable** privileged EXEC command: **show interface cable** *slot/port [downstream | upstream]*.

See the following sample **show interface cable** command output for a cable modem located in slot 6/port 0 using the earlier Cisco IOS Release 12.1(5)T1 software:

```
router# show interface cable 6/0
Cable6/0 is up, line protocol is up
  Hardware is BCM3210 FPGA, address is 00e0.1e5f.7a60 (bia 00e0.1e5f.7a60)
  Internet address is 1.1.1.3/24
  MTU 1500 bytes, BW 27000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation, loopback not set, keepalive not set
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 4d07h, output 00:00:00, output hang never
  Last clearing of “show interface” counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     10908 packets input, 855000 bytes, 0 no buffer
     Received 3699 broadcasts, 0 runts, 0 giants, 0 throttles
     3 input errors, 3 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     5412 packets output, 646488 bytes, 0 underruns
     0 output errors, 0 collisions, 13082 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Note For more recent images such as Cisco IOS Release 12.1(1a)T1 or higher, the **show interface upstream** command is enhanced to display details on the MAC scheduler state for an upstream port. Refer to “Enhanced Show Interface Upstream Output” section on page 4-30.

Table 4-16 Show Interface Cable Command Field Descriptions

Field	Description
Cable slot/port is up/...administratively down	Indicates whether the interface hardware is currently active or taken down by the administrator
line protocol is up/...administratively down	Indicates whether the software processes that handle the line protocol believe the interface is usable or if it has been taken down by the administrator
hardware	Hardware type and address
Internet address	Internet address followed by subnet mask
MTU	Maximum Transmission Unit (MTU) of the interface
BW	Bandwidth of the interface in kilobits per second
DLY	Delay of the interface in microseconds
rely	Reliability of the interface as a fraction of 255, calculated as an exponential average over 5 minutes. (For example, 255/255 is 100% reliability)
load	Load on the interface as a fraction of 255, calculated as an exponential average over 5 minutes. (For example, 255/255 is complete saturation.)
Encapsulation	Encapsulation method assigned to this interface.
ARP type	Type of Address Resolution Protocol (ARP) and timeout value assigned
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface
output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface
Last clearing of “show interface” counters	Time when the counters that measure cumulative statistics, such as number of bytes transmitted and received, were last reset to zero
Queueing strategy	Displays the type of queueing configured for this interface. In the example output, the type of queueing configured is First In First Out (FIFO)
Output queue	Number of packets in the output queue. The format of this number is A/B where A indicates the number of packets in the queue, and B indicates the maximum number of packets allowed in the queue
drops	Indicates the number of packets dropped due to a full queue
input queue/drops	Number of packets in the input queue. The format of this number is A/B where A indicates the number of packets in the queue, and B indicates the maximum number of packets allowed in the queue.

Table 4-16 Show Interface Cable Command Field Descriptions (continued)

Field	Description
drops	Indicates the number of packets dropped due to a full queue
Five minute input rate Five minute output rate	Average number of bits and packets transmitted per second in the last five minutes
packets input	Total number of error-free packets received by the system
bytes input	Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system
no buffer	Number of received packets discarded because there was no buffer space in the main system
Received broadcast	Total number of broadcast or multicast packets received by the interface
runts	Number of packets that are discarded because they are smaller than the medium's minimum packet size
giants	Number of packets that are discarded because they exceed the medium's maximum packet size
input errors	Includes runts, giants, no buffers, CRC, frame, overrun, and ignored counts
CRC	Indicates the number of times the cyclic redundancy checksum generated by the originating LAN station or far-end device does not match the checksum calculated from the data received
frame	Number of packets received incorrectly (with a CRC error and a non-integer number of octets)
overrun	Number of times the receiver hardware was unable to forward received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers
packets output	Total number of messages transmitted by the system
bytes	Total number of bytes, including data and MAC encapsulation, transmitted by the system
underruns	Number of times the transmitter ran faster than the receiving device could handle
output errors	Sum of all errors that prevented the final transmission of packets out of the interface being examined
interface resets	Number of times an interface has been completely reset

Table 4-16 Show Interface Cable Command Field Descriptions (continued)

Field	Description
output buffer failures	Number of times the output buffer has failed
output buffer swapped out	Number of times the output buffer has been swapped out

See the following sample output for the downstream cable interface of slot 6 on port 0 from the **show interface cable downstream** command:

```
router# show interface cable 6/0 downstream
Cable6/0: Downstream is up
     111947771 packets output, 1579682655 bytes, 0 discarded
     0 output errors
```

Table 4-17 Show Interface Cable Downstream Command Field Descriptions

Field	Description
Cable	Indicates the location of the downstream interface.
Downstream is up/...administratively down	Indicates the administrative state of the interface.
packets output	Total number of packets transmitted out of this interface.
bytes	Total number of bytes transmitted out of this interface
discarded	Total number of packets discarded
output errors	Sum of all errors that prevented downstream transmission of packets out of this interface

See the following sample output for the upstream cable interface located in slot 3/port 0 from the **show interface cable upstream** command:

```
router# show interface cable 3/0 upstream 0
Cable3/0: Upstream 0 is up
     Received 16873 broadcasts, 0 multicasts, 73310 unicasts
     0 discards, 89053 errors, 0 unknown protocol
     90183 packets input, 1 uncorrectable
     89042 noise, 0 microreflections
     Total Modems On This Upstream Channel : 8 (4 active)
     Default MAC scheduler
     Queue[Rng Polls]  0/20, fifo queueing, 0 drops
     Queue[Cont Mslots]  0/104, fifo queueing, 0 drops
     Queue[CIR Grants]  0/20, fair queueing, 0 drops
     Queue[BE Grants]  0/30, fair queueing, 0 drops
     Queue[Grant Shpr]   0/30, calendar queueing, 0 drops
     Reserved slot table currently has 0 CBR entries
     Req IEs 134469315, Req/Data IEs 0
     Init Mtn IEs 385879, Stn Mtn IEs 131059
     Long Grant IEs 10766, Short Grant IEs 15895
     Avg upstream channel utilization : 1%
     Avg percent contention slots : 97%
     Avg percent initial ranging slots : 0%
     Avg percent minislots lost on late MAPs : 0%
     Total channel bw reserved 0 bps
     CIR admission control not enforced
     Current minislot count   : 6676390    Flag: 0
     Scheduled minislot count : 6676545    Flag: 0
```

Table 4-18 describes the fields shown in the **show interface cable upstream** display.

Table 4-18 Show Interface Cable Upstream Command Field Descriptions

Field	Description
Cable	Indicates the location of the upstream interface
Upstream is up/...administratively down	Indicates the administrative state of the upstream interface
Received broadcasts	Number of broadcast packets received through this upstream interface
multicasts	Number of multicast packets received through this upstream interface
unicasts	Number of unicast packets received through this interface
discards	Number of packets discarded by this interface
errors	Sum of all errors that prevented upstream transmission of packets through this interface
unknown protocol	Number of packets received that were generated using a protocol unknown to the Cisco uBR7246
packets input	Number of packets received through this upstream interface that were free from errors
corrected	Number of error packets received through this upstream interface that were corrected
uncorrectable	Number of error packets received through this upstream interface that could not be corrected
noise	Number of upstream packets corrupted by line noise
microreflections	Number of upstream packets corrupted by microreflections
Guaranteed-rate service queue depth	Number of bandwidth requests queued up in the Guarantee-rate queue. This queue is only available to modems that have a reserved minimum upstream rate in their Class of Service
Best-effort service queue depth	Number of bandwidth requests queued up in the Best-effort queue. This queue is available to all modems that do not have any reserved rate on the upstream
Total Modems On This Upstream Channel	Number of cable modems currently sharing this upstream channel. This field also shows how many of these modems are active
Current Total Bandwidth Reserved	Total amount of bandwidth reserved by all modems sharing this upstream channel that require bandwidth reservation. The Class of Service for these modems specifies some non-zero value for the guaranteed-upstream rate. When one of these modems is admitted on the upstream, this field value is incremented by this guaranteed-upstream rate value

Table 4-18 Show Interface Cable Upstream Command Field Descriptions (continued)

Field	Description
CIR admission control (formerly: Current Admission Control Status)	Indicates the status of admission control on the upstream channel ENFORCED status allows users to enable admission control on a per port basis. This controls how limited bandwidth is allocated. NOT ENFORCED status indicates that there is no admission control. Every modem that registers with a class of service specifying a minimum upstream rate will be admitted by the CMTS regardless of how much aggregate bandwidth is actually available. Users enable admission control by using the admission control CLI
Default MAC scheduler	Indicates the status of the MAC scheduler as being in default mode as opposed to Automated Test Procedure (ATP)
Queue[Rng Polls]	The MAC scheduler queue showing the number of ranging polls
Queue[Cont Mslos]	The MAC scheduler queue showing the number of forced contention request slots in MAPS
Queue[CIR Grants]	The MAC scheduler queue showing the number of CIR grants pending
Queue[BE Grants]	The MAC scheduler queue showing the number of BE grants pending
Queue[Grant Shpr]	The MAC scheduler queue showing the number of grants that have been buffered for traffic shaping
drops	Number of packets dropped
Reserved slot table currently has 0 CBR entries	Number of CBR sessions active on an upstream channel at any given time
Req IEs	The running counter of request IEs sent in MAPS
Req/Data IEs	The counter of request/data IEs sent in MAPS
Init Mtn IEs	The counter of Initial Maintenance IEs
Stn Mtn IEs	Number of station maintenance (ranging poll) IEs
Long Grant IEs	Number of long grant IEs
Short Grant IEs	Number of short grant IEs
Avg upstream channel utilization	Indicates on average what percent of the upstream channel bandwidth is being used
Avg percent contention slots	Indicates on average what percent of slots are in contention state
Avg percent initial ranging slots	Indicates on average what percent of slots are in initial ranging state

Table 4-18 Show Interface Cable Upstream Command Field Descriptions (continued)

Field	Description
Avg percent minislots lost on late MAPs	Indicates on average what percent of slots are lost because a MAP interrupt was too late
Current minislot count (formerly: Last Minislot Stamp (current_time_base))	Indicates the current minislot count at the CMTS. FLAG indicates the timebase reference. This field is used only by developers.
Scheduled minislot count (formerly: Last Minislot Stamp (scheduler_time_base))	Indicates the furthest minislot count allocated at the indicated time. FLAG indicates the timebase reference. This field is used only by developers.

Enhanced Show Interface Upstream Output

The **show interface cable upstream** command is enhanced in Cisco IOS Release 12.0(7)XR2, Cisco IOS Release 12.1(1a)T1, or higher CMTS images to display detailed MAC scheduler state information for the upstream port. The example below illustrates the new display:

```
cmts#show interface cable 3/0 upstream 0
Cable3/0:Upstream 0 is up
     Received 13 broadcasts, 0 multicasts, 110 unicasts
     0 discards, 106 errors, 0 unknown protocol
     123 packets input, 0 uncorrectable
     106 noise, 0 microreflections
     Total Modems On This Upstream Channel :3 (3 active)
     Default MAC scheduler
     Queue[Rng Polls]  0/20, fifo queueing, 0 drops
     Queue[Cont Mslots]  0/104, fifo queueing, 0 drops
     Queue[CIR Grants]  0/20, fair queueing, 0 drops
     Queue[BE Grants]  0/30, fair queueing, 0 drops
     Queue[Grant Shpr]   0/30, calendar queueing, 0 drops
     Reserved slot table currently has 2 CBR entries
     Req IEs 280185, Req/Data IEs 0
     Init Mtn IEs 800, Stn Mtn IEs 49
     Long Grant IEs 26, Short Grant IEs 15
     Avg upstream channel utilization :1%
     Avg percent contention slots :97%
     Avg percent initial ranging slots :1%
     Avg percent minislots lost on late MAPs :0%
     Total channel bw reserved 192000 bps
     CIR admission control not enforced
     Current minislot count   :1165412    Flag:1
     Scheduled minislot count :1176227    Flag:1
```

New items in the display include:

- Detailed slot queue statistics---Queue [CIR Grants] 0/20, fair queueing, 0 drops in the example above means that the queue for CIR-service grants has a current depth of 0, a maximum depth of 20. Weighted fair queueing shows grants in this queue.
- CBR slot scheduling table state---The above reserved slot table has 2 CBR entries. This shows that at the time the command was issued, the MAC scheduler had admitted 2 CBR slots in the reserved slot table.

- Counters for each type of upstream slot scheduled in the MAPs for this upstream channel---The "Init Mtn IEs 800" means that the MAC scheduler has added 800 initial maintenance information elements (slots) at the time the show command was issued.
- MAC scheduling statistics to display what percentage of the upstream bandwidth is utilized for each type of slot on an average.

Show Interface Cable SID

To display per-SID counters for bandwidth requests, use the **show interface cable** privileged EXEC command: **show interface cable** *interface* sid [*sid*] **counters verbose**. Data transport over the RF link uses the registered SID address, rather than the Ethernet address. This allows multiple hosts to access the network by using a single cable modem.

Note Cisco IOS Release 12.0(7)XR2 and 12.1(1a)T1 adds the *verbose* option to provide SID details.

See the following display output for the **verbose** keyword extension for SID 1 on interface **cable slot 3, port 0**:

```
router# show interface c3/0 sid 1 counters verbose
 Sid                           : 1
 Input packets                 : 39
 Input octets                  : 15964
 Output packets                : 30
 Output octets                 : 8796
 BW requests received          : 40
 Grants issued                 : 40
 Rate exceeded BW request drops : 0
 Rate exceeded DS packet drops  : 0
```

See the following display output for the **verbose** keyword extension for all SIDs on the specified interface:

```
router# show interface c3/0 sid counters verbose
Sid                            : 1
Input packets                  : 39
Input octets                   : 15964
Output packets                 : 30
Output octets                  : 8796
BW requests received           : 40
Grants issued                  : 40
Rate exceeded BW request drops : 0
Rate exceeded DS packet drops  : 0
Sid                            : 2
Input packets                  : 0
Input octets                   : 0
Output packets                 : 0
Output octets                  : 0
BW requests received           : 0
Grants issued                  : 0
Rate exceeded BW request drops : 0
Rate exceeded DS packet drops  : 0
Sid                            : 3
Input packets                  : 0
Input octets                   : 0
Output packets                 : 0
Output octets                  : 0
BW requests received           : 0
Grants issued                  : 0
Rate exceeded BW request drops : 0
Rate exceeded DS packet drops  : 0
```

See the following display for the SIDs connected to the specified interface:

```
Lab-CMTS# show inter cab 3/0 sid
Sid  Prim Type Online     Admin   QoS Create      IP Address        MAC Address
     Sid       State      Status      Time
23        stat init(d)    enable  2   04:00:54    209.165.200.0     0050.7366.17ab
24        stat init(d)    enable  2   04:00:58    209.165.200.0     0050.7366.1803
25        stat init(rc)   enable  2   04:01:05    209.165.200.0     00d0.bad3.c459
26        stat init(d)    enable  2   04:01:10    209.165.200.0     0050.7366.1801
27        stat offline    enable  2   04:01:31    209.165.200.225   0090.8330.0213
28        stat offline    enable  2   04:01:59    209.165.200.226   0090.8330.0211
29        stat offline    enable  2   04:02:07    209.165.200.227   0090.8330.0214
30        dyn  init(o)    enable  2   04:03:09    209.165.200.228   0090.833
```

See the following connection information for all SIDs on the specified interface:

```
router# show interface c3/0 sid connectivity
Sid   1st time    Times  %online     Online time            Offline time
      online      Online           min     avg     max     min     avg     max
1     15:37:24    1      99.73   00:00   1h45m   1h45m   00:17   00:17   00:17
2     15:37:24    1      99.73   00:00   1h45m   1h45m   00:17   00:17   00:17
3     15:37:24    1      99.73   00:00   1h45m   1h45m   00:17   00:17   00:17
```

See the following connection information for SID 1 on the specified interface:

```
router# show interface c3/0 sid 1 connectivity
Sid   1st time    Times  %online     Online time            Offline time
      online      Online           min     avg     max     min     avg     max
1     15:37:24    1      99.72   00:00   1h41m   1h41m   00:17   00:17   00:17
```

See the following display for the counters of the SIDs connected to the specified interface:

```
router# show interface c3/0 sid counters
 Sid   Inpackets  Inoctets   Outpackets Outoctets  Ratelimit  Ratelimit
                                                   BWReqDrop  DSPktDrop
 1     40         16586      31         9160       0          0
 2     0          0          0          0          0          0
 3     0          0          0          0          0          0
```

See the following display for the counters of SID 1 on the specified interface:

```
router# show interface c3/0 sid 1 counters
Sid   Inpackets  Inoctets   Outpackets Outoctets  Ratelimit  Ratelimit
                                                  BWReqDrop  DSPktDrop
1     39         15964      30         8796       0          0
```

Table 4-19 describes the fields shown in the output for the **show interface cable sid** displays.

Table 4-19 show interface cable sid Command Field Descriptions

Field	Description
Sid	Service identification number
Prim Sid	The primary service identifier assigned to the modem
Type	Indicates this SID was created statically at the time of registration or dynamically by the exchange of dynamic service messages between the CM and CMTS
Online State	“Online” means the modem owning this SID is processing traffic. “Offline” means the modem owning this SID is not processing traffic
Admin Status	“Disable” means that the SID has been turned off. “Enable” is the normal state
QoS	Quality of service.
Create time	When the SID was created, number of seconds since the system booted
Input octets (Inoctets)	Number of octets received by using this SID
Input packets (Inpackets)	Number of packets received by using this SID
Output octets (Outoctets)	Number of octets sent from this SID
Output packets (Outpackets)	Number of packets sent from this SID
IP address	IP address of the modem owning this SID
MAC address	MAC address of the modem owning this SID
BW requests received	Number of bandwidth requests received by this SID
Grants issued	Number of bandwidth requests granted by this SID
Rate exceeded BW request drops	Number of bandwidth requests not granted by this SID

Table 4-19 show interface cable sid Command Field Descriptions (continued)

Field	Description
Rate exceeded DS packet drops	Number of downstream packets lost by this SID
Ratelimit BWReqDrop	Number of bandwidth requests not granted by this SID
Ratelimit DSPktDrop	Number of downstream packets lost by this SID
1st time online	Time at which the modem with this SID connected
Times online	Number of times the modem with this SID has connected
% online	Percentage of time the modem with this SID has been connected
Online time	The minimum, average, and maximum number of hours and minutes the modem with this SID has been connected
Offline time	The minimum, average, and maximum number of hours and minutes the modem with this SID has been disconnected

Show Cable QoS Profile

Following is a response to the **show cable qos profile** command. The display shows ToS specifications:

```
uBR7200#show cable qos profile

Service Prio Max       Guarantee Max        Max tx TOS  TOS   Create     B
class        upstream  upstream  downstream burst  mask value by         priv
>              bandwidth bandwidth bandwidth                              enab
1       0    0         0         0          0      0x0  0x0   cmts(r)    no
2       0    64000     0         1000000    0      0x0  0x0   cmts(r)    no
3       0    1000      0         1000       0      0x0  0x0   cmts       no
4       3    256000    0         512000     0      0x0  0x0   cm         no
5       5    1000000   0         10000000   0      0x0  0x0   cm         no
6       3    256000    0         512000     0      0x0  0x0   cm         yes
```

Note The “r” in the “Create by” column means the first two classes of service the CMTS creates are reserved for CMs that are not online.

Displays upstream packet discards, errors, error-free packets, correctable and uncorrectable errors, noise and microreflection statistics:

```
show  interface slot/downstream-port upstream
```

Troubleshooting Using Cable Flap Lists

The Cisco uBR7200 series universal broadband routers maintain a database of flapping cable modems to assist in locating cable plant problems. The flapping cable modem detector tracks the upstream and downstream performance of all cable modems on the network, without impacting throughput and performance, or creating additional packet overhead on the broadband network. The cable modem flap

list keeps track of the cable modem MAC address, up and down transitions, registration events, missed periodic ranging packets, upstream power adjustments and the physical interface on the Cisco uBR7200 series.

Note Although this is a Cisco proprietary CMTS feature, it is compatible with all DOCSIS-compliant cable modems. Unlike SNMP, the flap list uses zero bandwidth.

The flap list collects the following station maintenance statistics:

- Detects interface up/down flap; the reinsertion counter counts the number of times a cable modem comes up and inserts into the network. This helps identify potential problems in the downstream because improperly provisioned cable modems tend to try to reestablish a link repeatedly.
- Detects intermittent upstream; the keepalive hits versus misses is the number of times cable modems don't respond or don't respond to the MAC layer keepalive messages. If there are a number of misses, this points to a potential problem in the upstream.
- Lists cable modem MAC addresses sorted by flap rate or most recent flap time.
- Shows power adjustment statistics during station maintenance polling; this represents the number of times the CMTS tells a cable modem to adjust the transmit power more than 3 dB. If constant power adjustments are detected, this usually indicates a problem with an amplifier. By looking at the cable modems in front and behind various amplifiers, you can find the source of failure.

The cable system administrator typically:

- Sets up a script to periodically poll the flap list, for example, every 15 minutes
- Uses the resulting data to perform trend analysis to identify the cable modems that are consistently in the flap list
- Queries the billing and administrative database for cable modem MAC address-to-street address translation and generates a report

These reports can be given to the Customer Service Department or the cable plant's Operations and Maintenance Department. Using these reports, maintenance personnel can quickly discern how characteristic patterns of flapping cable modems, street addresses, and flap statistics can indicate which amplifier or feeder lines are faulty. The reports also help you quickly discern whether problems exist in your downstream or upstream path, and whether the problem is ingress noise or equipment related.

Default values for the following flap-list configuration commands are:

- **cable flap-list miss-threshold**—6 seconds
- **cable flap-list power-adjust**—2 dB
- **cable flap-list insertion-time**—180 seconds

Note Since the cable flap list was originally developed, polling mechanisms have been enhanced since Cisco IOS Release 11.3.7 NA to have an increased rate of 1/sec when polls are missed. Cable modems go offline faster than the frequency hop period. This can cause the frequency to stay fixed while cable modems go offline. To compensate for this, as appropriate, you can reduce the hop period to 10 seconds.

Tips In Cisco IOS Release 12.0(7)XR2, Cisco IOS Release 12.1(1a)T1, and higher, the system supports automatic power adjustments. The **show cable flap-list** and **show cable modem** commands now indicate when the Cisco uBR7200 series router has detected an unstable return path for a particular modem and has compensated with a power adjustment. An asterisk appears in the power adjustment field for a modem when a power adjustment has been made; an exclamation point appears when the modem has reached its maximum power transmit level and cannot increase its power level any further.

The following tips and scenarios allow you to use the flap list in the most effective way:

- If a subscriber's cable modem shows a lot of flap list activity, it is having communication problems.
- If a subscriber's cable modem shows little or no flap list activity, it is communicating reliably; the problem is probably in the subscriber's computer equipment or in the connection to the cable modem.
- The top 10% most active cable modems in the flap list are most likely to have difficulties communicating with the headend.
- Cable modems with more than 50 power adjustments per day have a suspect upstream path.
- Cable modems with approximately the same number of hits and misses and with a lot of insertions have a suspect downstream path (for example, low level into the cable modem).
- All cable modems incrementing the insertion at the same time indicates a provisioning server failure.
- Cable modems with high CRC errors have bad upstream paths or in-home wiring problems.
- Correlating cable modems on the same physical upstream port with similar flap list statistics can quickly resolve outside plant problems to a particular node or geography.
- Monitoring the flap list cannot affect cable modem communications.
- The flap list should be saved to a database computer and cleared at least once a day.
- Important upstream performance data can be obtained by tracking flap list trend data.
- Important installation quality control and performance data is directly available from the flap list.

Following is a sample response to the **show cable flap** command:

```
uBR7200#show cable flap

Mac Addr       CableIF    Ins    Hit   Miss    CRC  P-Adj   Flap    Time
0010.9500.461f C3/0 U1     56  18857    887      0      1    116 Jun 1  14:09:12
0010.9500.446e C3/0 U1     38  18686   2935      0      1     80 Jun 2  19:03:57
0010.9500.38ec C3/0 U2     63  18932   1040      0      8    138 Jun 2  23:50:53
0010.9500.4474 C3/0 U2     65  18913   1053      0      3    137 Jun 2  09:30:09
0010.9500.4672 C3/0 U2     56  18990   2327      0      6    124 Jun 2  10:44:14
0010.9500.38f0 C3/0 U2     50  18964   2083      0      5    111 Jun 2  20:46:56
0010.9500.e8cb C3/0 U2      0   6537    183      0      1      5 Jun 2  22:35:48
0010.9500.38f6 C3/0 U3     50  19016   2511      0      2    104 Jun 2  07:46:31
0010.9500.4671 C3/0 U4     43  18755   3212      1      1     89 Jun 1  19:36:20
0010.9500.38eb C4/0 U0     57  36133   1608      0      6    126 Jun 2  20:04:58
0010.9500.3ce2 C4/0 U0     44  35315   1907      0      4     99 Jun 2  16:42:47
0010.9500.e8d0 C4/0 U2      0  13213    246      0      1      5 Jun 3  04:15:30
0010.9500.4674 C4/0 U4     56  36037   2379      0      4    121 Jun 3  00:34:12
0010.9500.4677 C4/0 U4     40  35781   2381      0      4     91 Jun 2  12:14:38
0010.9500.4614 C5/0 U5     40  21810   2362      0    502    586 Jun 2  21:43:02
0010.9500.3be9 C6/0 U5     63  22862    969      0      0    128 Jun 1  14:09:03
0010.9500.4609 C6/0 U5     55  22723   2127      0      0    112 Jun 1  14:08:02
0010.9500.3cb8 C6/0 U5     49  22607   1378      0      0    102 Jun 1  14:08:58
0010.9500.460d C6/0 U5     46  22477   2967      0      2     96 Jun 2  17:03:48
0010.9500.3cba C6/0 U5     39  22343   3058      0      0     81 Jun 1  14:13:16
0010.9500.3cb4 C6/0 U5     38  22238   2936      0      0     79 Jun 1  14:09:26
0010.9500.4612 C6/0 U5     38  22306   2928      0      0     79 Jun 1  14:09:29
```

The command line with an arrow next to it reveals a cable modem that is continuously flapping. A high flap rate indicates that the cable modem is power adjusting frequently. This can indicate a problem with an amplifier. The number reveals the number of times the CMTS instructed the cable modem to adjust the transmit power more than 3 dB.

Cable modems are automatically added to the flap list when any of the following conditions are detected:

- When the cable modem re-registers more frequently than the user-specified insertion time.
- When intermittent keepalive messages are detected between the CMTS and the cable modem.
- When the cable modem's upstream transmit power is adjusted beyond the user-specified power threshold.

Display the Flap List

The flap list can be queried either using the standard Simple Network Management (SNMP) API or the CLI. Using any third party SNMP Management Information Base (MIB) browser, you can query the ***ccsFlapTable*** in the CISCO-CABLE-SPECTRUM-MIB, a proprietary extension to the DOCSIS MIBs.

Using the **show cable flap list** command, the flap list statistics are accessed. A sample appears below. Each of the columns in the display are described in Table 4-20:

```
        MAC ID    CableIF     Ins  Hit    Miss    CRC  P-Adj    Flap   Time
0010.7b6b.60ad C3/0 U0       0  14386   1390      1     38       41   Nov 24 21:34:24
0010.7b6b.65a3 C3/0 U0       0  14503   1264      1     33       37   Nov 24 21:28:09
0010.7b6b.6b9d C3/0 U0       0  14060   1726      3     40       43   Nov 24 21:18:36
```

Table 4-20 Flap List Statistics Description

Statistic	Description
MAC ID	This is the MAC-layer address of a cable modem. The first six digits indicate the vendor ID of the cable modem manufacturer, followed by six digits indicating a unique host address. Each cable modem's MAC address is unique.
Cable IF	This is the physical upstream interface on the Cisco uBR7200. It denotes the cable modem card slot number, the downstream port number on the RF line card and the upstream port number on the same cable modem card. The flap list data can be sorted based on the upstream port number which is useful when isolating reverse path problems unique to certain combining groups.
Insertions	Link insertion is the process whereby a modem performs an initial maintenance procedure to establish link with the CMTS. The **Ins** column is the flapping modem's insertion count and indicates the number of times the RF link was abnormally re-established. An abnormality is detected when the time between link re-establishment attempts is less than the user-configurable parameter. Normal modem activity follows the sequence below. • The initial link insertion is followed by a keepalive loop between the CMTS and cable modem and is called station maintenance. • Power-on • Initial maintenance • Station maintenance • Power-off When the link is broken, initial maintenance is repeated to re-establish the link. Initial maintenance @ Time T1 Station maintenance Init maintenance @ Time T2 The ***Ins*** and ***Flap*** counters in the flap list are incremented whenever T2 – T1 < N where N is the insertion-time parameter configured in <*cable flap-list insertion-time*>. Default value for this parameter is ***TBD seconds.*** A high **Ins** number indicates: • Intermittent downstream sync loss • DHCP or modem registration problems

Table 4-20 Flap List Statistics Description

Hit and Miss	The **HIT** and **MISS** columns are keepalive polling statistics between the Cisco uBR7200 series and the cable modem. The station maintenance process occurs for every modem approximately every 25 seconds. When the CMTS receives a response from the modem, the event is counted as a **Hit**. If the CMTS does not receive a response from the cable modem, the event is counted as a **Miss.** A cable modem will fail to respond either because of noise or if it is down. Modems which only log **Misses** and zero **Hits** are assumed to be powered off. **Misses** are not desirable since this is usually an indication of a return path problem; however, having a small number of misses is normal. The flap count is incremented if there are *M* consecutive misses where *M* is configured in the *cable flap miss-threshold* parameter. The parameter value ranges from 1 to 12 with a default of 6. Ideally, the **HIT** count should be much greater than the **Miss** counts. If a modem has a **HIT** count much less than its **MISS** count, then registration is failing. Noisy links cause the **MISS/HIT** ratio to deviate from a nominal 1% or less. High **Miss** counts can indicate: • Intermittent upstream possibly due to noise • Laser clipping • Common-path distortion • Ingress or interference • Too much or too little upstream attenuation
Cyclical Redundancy Check (CRC)	This statistic tracks the **CRC** error counter per modem. **CRC** errors are usually an indication of noise on a plant. A low count can be always be expected but a high **CRC** number calls for some the plant troubleshooting. The **CRC** counter indicates: • Intermittent upstream • Laser clipping • Common-path distortion • Impulsive noise or interference
Power Adjustments (P-Adj)	The station maintenance poll in the CMTS constantly adjusts the modem transmit power, frequency, and timing. The **P-Adj** column indicates the number of times the modem's power adjustment exceeded the threshold value. The power adjustment threshold may be set using the <*cable flap power threshold* > parameter with a value range of 0 to 10 dB and a default value of 2 dB. Tuning this threshold is recommended to decrease irrelevant entries in the flap list. Power Adjustment values of 2 dB and below will continuously increment the **P-Adj** counter. The modem transmitter step size is 1.5 dB, whereas the headend may command 0.25 dB step sizes. Power adjustment flap strongly suggests upstream plant problems such as: • Amplifier degradation • Poor connections • Thermal sensitivity • Attenuation problem

Table 4-20 Flap List Statistics Description

Flap	The **Flap** counter indicates the number of times the modem has flapped. This counter is incremented when one of the following events is detected: Unusual modem insertion or reregistration attempts. The **Flap** and the **Ins** counters are incremented when the modem tries to reestablish the RF link with the CMTS within a period of time that is less than the user-configurable insertion interval value. Abnormal Miss/Hit ratio The **Flap** counter is incremented when *N* consecutive Misses are detected after a Hit where *N* can be user-configurable with a default value of 6. Unusual power adjustment The **Flap** and **P-adj** counters are incremented when the modem's upstream power is adjusted beyond a user-configurable power level.
Time	**Time** is the timestamp indicating the last time the modem flapped. The value is based on the clock configured on the local Cisco uBR7200 series. If no time is configured, this value is based on the current uptime of the Cisco uBR7200 series. When a modem meets one of the three flap list criteria, the **Flap** counter is incremented and **Time** is set to the current time.

Troubleshoot with the Flap List

This section includes suggestions on how to interpret different network conditions based on the flap list statistics:

- **Condition 1:** Low miss/hit ratio (< 10% for MC11 card, < 2% for MC16 card), low insertion, low P-adj, low flap counter and old timestamp.
  Analysis: This exhibits an optimal network situation.
- **Condition 2:** High ratio of misses over hits (> 10%)
  Analysis: Hit/miss analysis should be done after the "Ins" count stops incrementing. In general, if the hit and miss counts are about the same order of magnitude, then the upstream may be experiencing noise. If the miss count is greater, then the modem is probably dropping out frequently and not completing registration. The upstream or downstream is perhaps not stable enough for reliable link establishment. Very low hits and miss counters and high insertion counters indicate provisioning problems.
- **Condition 3:** Relatively high power adjustment counter.
  Analysis: Indicates the power adjustment threshold is probably set at default value of 2 dB adjustment. The modem transmitter step size is 1.5 dB, whereas the headend may command 0.25 dB step sizes. Tuning your power threshold to 6 dB is recommended to decrease irrelevant entries in the flap list. The power adjustment threshold may be set using *<cable flap power threshold <0-10 dB>>* from the Cisco IOS global configuration mode. A properly operating HFC network with short amplifier cascades can use a 2-3 dB threshold.
- **Condition 4:** High P-Adj and CRC errors.
  Analysis: This condition can indicate that the fiber node is clipping the upstream return laser. Evaluate the modems with the highest CRC count first. If the modems are not going offline (Ins = 0), this will not be noticed by the subscriber. However, they could receive slower service due to dropped IP packets in the upstream. This condition will also result in input errors on the Cisco uBR7200 series cable interface.
- **Condition 5:** High insertion rate.
  Analysis: If link re-establishment happens too frequently, then the modem is usually having a registration problem.This is indicated by a high 'Ins' counter which tracks the 'Flap' counter.

Set Cable Flap List Aging

You can specify the number of days to record and retain flapping activity on cable modems currently in the flap-list table. This value is known as the age of the flap list. The valid range is from 1 to 60 days.

To set the age of the flap list, use the following command in global configuration mode.

Table 4-21 Instructions to Set Cable Flap List Aging

Command	Purpose
`CMTS01(config)# cable flap-list aging` *days*	Specify the number of days to record and retain flapping activity for the cable modems connected to this Cisco uBR7200 series.

Verify Cable Flap List Aging

To verify that cable flap list aging is set, enter the **show cable flap list** command:

```
CMTS01# show cable flap list
Mac Addr       CableIF    Ins    Hit   Miss    CRC  P-Adj   Flap    Time
0010.7b6b.5d1d C3/0 U0      0    688    169      0      0      3 Nov 5  12:28:50
0010.7b6b.5e15 C3/0 U0      1    707    185      0      0      5 Nov 5  12:29:52
0010.7b6b.5e27 C3/0 U0      1    707    198      0      0      5 Nov 5  12:29:55
0010.7b6b.5d29 C3/0 U0      1    709    205      0      0      5 Nov 5  12:29:52
0010.7b6b.5e2b C3/0 U0      1    710    204      0      0      7 Nov 5  12:30:16
```

Set Cable Flap List Insertion Time

You can set the cable flap list insertion time. When a cable modem makes an insertion request more frequently than the amount of insertion time defined by this command, the cable modem is placed in the flap list for activity recording. The valid range is from 60 to 86400 seconds.

To set the cable flap list insertion time, use the following command in global configuration mode.

Table 4-22 Instructions to Set Cable Flap List Insertion Time

Command	Purpose
`CMTS01(config)# cable flap-list insertion-time` *seconds*	Specify the insertion time in seconds. Any cable modem that makes an insertion request more frequently than this period of time is placed in the flap list.

Verify Cable Flap List Insertion Time

To verify cable flap list insertion time, enter the **show cable flap list** command:

```
CMTS01# show cable flap list
Mac Addr       CableIF    Ins    Hit   Miss    CRC  P-Adj   Flap    Time
0010.7b6b.5d1d C3/0 U0      0    688    169      0      0      3 Nov 5  12:28:50
0010.7b6b.5e15 C3/0 U0      1    707    185      0      0      5 Nov 5  12:29:52
0010.7b6b.5e27 C3/0 U0      1    707    198      0      0      5 Nov 5  12:29:55
0010.7b6b.5d29 C3/0 U0      1    709    205      0      0      5 Nov 5  12:29:52
0010.7b6b.5e2b C3/0 U0      1    710    204      0      0      7 Nov 5  12:30:16
```

Set Cable Flap List Power Adjustment Threshold

You can specify the power adjustment threshold that will cause a flap-list event to be recorded. When the power adjustment of a cable modem meets or exceeds the threshold, the cable modem is placed in the flap list. The valid range is from 1 to 10 dBmV.

Note A power adjustment threshold of less than 2 dBmV might cause excessive flap list event recording. Cisco recommends setting this threshold value to 3 dBmV or higher.

To set the power adjustment threshold for flap-list events, use the following command in global configuration mode.

Table 4-23 Instruction to Set Cable Flap List Power Adjustment Threshold

Command	Purpose
`CMTS01(config)# cable flap-list power-adjust threshold` *dbmv*	Specify the minimum power adjustment that will constitute a flap-list event.

Verify Cable Flap List Power Adjustment Threshold

To verify the cable flap list power adjustment threshold, enter the **show cable flap list** command:

```
CMTS01# show cable flap list
Mac Addr       CableIF    Ins    Hit   Miss    CRC  P-Adj   Flap    Time
0010.7b6b.5d1d C3/0 U0      0    688    169      0      0      3 Nov 5  12:28:50
0010.7b6b.5e15 C3/0 U0      1    707    185      0      0      5 Nov 5  12:29:52
0010.7b6b.5e27 C3/0 U0      1    707    198      0      0      5 Nov 5  12:29:55
0010.7b6b.5d29 C3/0 U0      1    709    205      0      0      5 Nov 5  12:29:52
0010.7b6b.5e2b C3/0 U0      1    710    204      0      0      7 Nov 5  12:30:16
```

Set Cable Flap List Miss Threshold

You can specify the miss threshold for recording a flap-list event. A miss is the number of times a cable modem does not acknowledge a MAC layer keepalive message from a cable modem card. An 8% miss rate is normal for the Cisco cable modem cards. When the number of misses exceeds the threshold, the cable modem is placed in the flap list.

Note A high miss rate can indicate intermittent upstream problems, fiber laser clipping, or common-path distortion.

To set the miss threshold for recording a flap-list event, use the following command in global configuration mode.

Table 4-24 Instructions to Set Cable Flap List Miss Threshold

Command	Purpose
`CMTS01(config)# cable flap-list miss-threshold` *misses*	Specify the number of MAC-layer keepalive misses that will result in the cable modems being place in the flap list.

Verify Cable Flap List Miss Threshold

To verify the cable flap list miss threshold, enter the **show cable flap list** command:

```
CMTS01# show cable flap list
Mac Addr       CableIF    Ins    Hit   Miss    CRC  P-Adj   Flap    Time
0010.7b6b.5d1d C3/0 U0      0    688    169      0      0      3 Nov 5  12:28:50
0010.7b6b.5e15 C3/0 U0      1    707    185      0      0      5 Nov 5  12:29:52
0010.7b6b.5e27 C3/0 U0      1    707    198      0      0      5 Nov 5  12:29:55
0010.7b6b.5d29 C3/0 U0      1    709    205      0      0      5 Nov 5  12:29:52
0010.7b6b.5e2b C3/0 U0      1    710    204      0      0      7 Nov 5  12:30:16
```

Set Cable Flap List Size

You can specify the maximum number of cable modems that can be listed in the cable flap list tables. The valid range is from 1 to 8192 cable modems. The default is 8192 cable modems.

To specify the maximum number of cable modems that can be recorded in the flap list, use the following command in global configuration mode.

Table 4-25 Instructions to Set Cable Flap List Size

Command	Purpose
`CMTS01(config)# cable flap-list size` *number*	Specify the maximum size of the flap list.

Verify Cable Flap List Size

To verify the cable flap list size, enter the **show cable flap list** command:

```
CMTS01# show cable flap list
Mac Addr       CableIF    Ins    Hit   Miss    CRC  P-Adj   Flap    Time
0010.7b6b.5d1d C3/0 U0      0    688    169      0      0      3 Nov 5  12:28:50
0010.7b6b.5e15 C3/0 U0      1    707    185      0      0      5 Nov 5  12:29:52
0010.7b6b.5e27 C3/0 U0      1    707    198      0      0      5 Nov 5  12:29:55
0010.7b6b.5d29 C3/0 U0      1    709    205      0      0      5 Nov 5  12:29:52
0010.7b6b.5e2b C3/0 U0      1    710    204      0      0      7 Nov 5  12:30:16
```

Clear Cable Flap List

To remove a single cable modem from the flap list or to remove all cable modems from the flap list, use one of the following commands in global configuration mode.

Table 4-26 Instructions to Clear Cable Flap List

Command	Purpose
`CMTS01(config)# clear cable flap-list` *mac-addr*	Clear the entries in the cable flap list for the cable modem with this MAC address.
`CMTS01(config)# clear cable flap-list all`	Clear the entries for all of the cable modems in the flap list.

Customize Other Flap List Values and Related Commands

The following displays flap list with different sorting options:

show cable modem flap-list *[cable <n> | sort-flap | sort-time | sort-interface]*

The following sets the threshold value for link establishment:

[no] **cable flap-list insertion-time** <*sec*>

Note A modem is tagged as flapping if the insertion time exceeds this value. Its value can be set from 60 to 86400 seconds with a default of 180 seconds.

The following sets the number of consecutive missed station maintenance(RNG-RSP) messages that must be missed for a 'flap' event to occur. Value ranges from 1-12 with a default of 6 seconds. The hits and miss counters are not affected:

[no] **cable flap-list miss-threshold** <*miss-threshold*>

The following clears the counters for a cable modem (or all cable modems) in the station maintenance list:

clear cable modem *{ <mac-addr> | <ip-addr> | all }* **counters**

The following displays the QoS, modem status, In and Out octets, IP and MAC addresses per SID:

show int cable slot/port **sid**

The following drops the modem's RF link by removing a modem from the keep-alive polling list. This forces the modem to reset:

clear cable-modem *{ <mac-addr> | <ip-addr> | all }* **reset**

The following uses a MAC layer ping to determine if the cable modem is online. It uses smaller data units on the wire than a standard IP ping, resulting in lower overhead. Works even if the IP layer in the modem is down or hasn't completed registration:

ping DOCSIS cable-modem <*mac-addr | IP address >*

The following displays the timing offset, receive power, and QoS values by cable interface, SID, and MAC address:

show cable modem *[<ip-address> | <MAC-address>]*

The following displays the current allocation table and frequency assignments:

show cable spectrum-group *[spectrum group number]*

The following displays maximum, average, and minimum% online time and offline times for a given SID on a given Cisco uBR7200 interface:

show int *slot/port* **sid connectivity**

The following displays input and output rates, input errors, CRC, frames, overruns, underruns, collisions, interface resets. High input errors in the CMTS retrieved from this query suggests noisy upstream. In older versions of the chassis, loose midplane and line card screws caused a similar problem:

show interface *slot/downstream-port*

Performing Amplitude Averaging

The Cisco uBR7200 series uses an averaging algorithm to determine the optimum power level for a cable modem with low carrier-to-noise ratio that is making excessive power adjustments—known as flapping. To avoid dropping flapping cable modems, the Cisco uBR7200 series universal broadband router averages a configurable number of RNG-REQ messages before it makes power adjustments. By compensating for a potentially unstable return path, the Cisco uBR7200 series router maintains connectivity with affected cable modems. You can interpret these power adjustments, however, as indicating unstable return path connections.

The **show cable flap-list** and **show cable modem** commands are expanded to indicate which paths the Cisco uBR7200 series is making power adjustments and which modems have reached maximum transmit power settings. These conditions indicate unstable paths that should be serviced.

The following example shows the output of the **show cable flap-list** command:

```
router# show cable flap-list
MAC Address     Upstream     Ins   Hit   Miss  CRC   P-Adj Flap  Time
 0010.7bb3.fd19  Cable5/0/U1  0     2792  281   0     *45    58    Jul 27 16:54:50
 0010.7bb3.fcfc  Cable5/0/U1  0     19    4     0     !43    43    Jul 27 16:55:01
 0010.7bb3.fcdd  Cable5/0/U1  0     19    4     0     *3     3     Jul 27 16:55:01
```

The * symbol indicates that the CMTS is using the power adjustment method on this modem. The ! symbol indicates that the modem has reached maximum transmit power.

Output of the **show cable modem** command appears below:

```
router# show cable modem
 Interface   Prim Online     Timing Rec    QoS CPE IP address      MAC address
             Sid  State      Offset Power
 Cable3/0/U0 1    online     2257    0.00  3   0   10.30.128.142   0090.8330.0217
 Cable3/0/U0 2    online     2262  *-0.50  3   0   10.30.128.145   0090.8330.020f
 Cable3/0/U0 3    online     2260    0.25  3   0   10.30.128.146   0090.8330.0211
 Cable3/0/U0 4    online     2256   *0.75  3   0   10.30.128.143   0090.8330.0216
 Cable3/0/U0 5    online     2265   *0.50  3   0   10.30.128.140   0090.8330.0214
 Cable3/0/U0 6    online     2256    0.00  3   0   10.30.128.141   0090.8330.0215
 Cable3/0/U0 7    online     4138  !-1.00  3   1   10.30.128.182   0050.7366.124d
 Cable3/0/U0 8    online     4142  !-3.25  3   1   10.30.128.164   0050.7366.1245
 Cable3/0/U0 9    online     4141  !-3.00  3   1   10.30.128.185   0050.7366.17e3
 Cable3/0/U0 10   online     4142  !-2.75  3   0   10.30.128.181   0050.7366.17ab
 Cable3/0/U0 11   online     4142  !-3.25  3   1   10.30.128.169   0050.7366.17ef
```

Similar to the **show cable flap-list** display, the * symbol in the **show cable modem** output indicates that the CMTS is using the power adjustment method on this CM. The ! symbol indicates that the CM has reached maximum transmit power.

This section documents the commands pertaining to amplitude averaging:

- **cable upstream power-adjust noise**
- **cable upstream frequency-adjust averaging**

Enable or Disable Power Adjustment

To enable or disable the power adjustment capability, use the following commands:

cable upstream *n* **power-adjust** {**threshold** [*threshold #*] | **continue** [*tolerable value*] | **noise** [*% of power adjustment*]}

no cable upstream power-adjust

Table 4-27 Cable Upstream Power Adjust Syntax Descriptions

Syntax	Valid Values
n	Specifies the upstream port number.
threshold #	Specifies the power adjustment threshold. The threshold range is from 0 through 10 dB. The default is 1 dB.
tolerable value	Determines if the status of the RNG-RSP should be set to CONTINUE or SUCCESS. The range is from 2 through 15 dB. The default is 2 dB.
% of power adjustment	Specifies the percentage of power adjustment packets required to switch from the regular power adjustment method to the noise power adjustment method. Range is from 10 through 100 percent. The default is 30 percent.

Note The threshold default is 1 dB. The tolerable value default is 2 dB. The power adjustment is 30 percent.

Caution Default settings are adequate for system operation. Amplitude averaging is an automatic procedure. In general, Cisco does not recommend you adjust values. Cisco does recommend, however, that you clean up your cable plant should you encounter flapping cable modems.

Note In some instances, you might adjust certain values:

If CMs cannot complete ranging because they have reached maximum power levels, you might try to set the *tolerable value* CONTINUE field to a larger value than the default of 2 dB. Values larger than 10 dB on “C” versions of cable modem cards, or 5 dB on FPGA versions, are not recommended.

If the flap list shows CMs with a large number of power adjustments, but the CMs are not detected as “noisy,” you might try to decrease the percentage for “noisy.” If you think too many CMs are unnecessarily detected as “noisy,” you might try to increase it.

Set Frequency Threshold to Affect Power Adjustment

To control power adjustment methods by setting the frequency threshold, use the **cable upstream freq-adj averaging** interface configuration command. To disable power adjustments, use the **no** form of this command.

cable upstream *n* **freq-adj averaging** *% of frequency adjustment*

no cable upstream freq-adj averaging

Table 4-28 Cable Upstream Freq-adj Averaging Syntax Descriptions

Syntax	Valid Values
n	Specifies the upstream port number.
averaging	Specifies that a percentage of frequency adjustment packets is required to change the adjustment method from the regular power adjustment method to the noise power adjustment method.
% of frequency adjustment	Specifies the percentage of frequency adjustment packets required to switch from the regular power adjustment method to the noise power adjustment method. Valid range is from 10 through 100 percent.

The following example shows how to change the power adjustment method when the frequency adjustment packet count reaches 50 percent:

```
router(config-if)# cable upstream 0 freq-adj averaging 50
```

Setting Downstream Test Signals

This feature provides configuration commands that allow you to create downstream test signals. Both Pseudo Random Bit Stream (PRBS) and unmodulated carrier test signals are now supported.

A PRBS test signal is a random data pattern that has been modulated to look like a real data stream. An unmodulated test signal is a continuous sine wave that looks like a carrier wave on the downstream transmission.

See the following required tasks to create PRBS and unmodulated carrier test signals:

- Configure Unmodulated Test Signals
- Configure PRBS Test Signals

Configure Unmodulated Test Signals

Table 4-29 Instructions to Configure Unmodulated Test Signals

Step	Command	Purpose
1.	`# router(config-if)# cable downstream if-output continuous-wave`	Generates an unmodulated continuous-wave signal on the downstream channel. The interface is shut down.
2.	`Router(config-if)# no cable downstream if-output`	Stops sending test signals. **Note** Remember to reenable the interface to resume normal operations.

Configure PRBS Test Signals

Table 4-30 Instructions to Configure PRBS Test Signals

Step	Command	Purpose
1.	`# router(config-if)# cable downstream if-output prbs`	Generates a PRBS test signal on the downstream channel. The interface is shut down.
2.	`Router(config-if)# no cable downstream if-output`	Stops sending test signals.

Note Remember to reenable the interface to resume normal operations.

Verify Test Signal Output

To verify the output of a continuous-wave test signal or the output of a PRBS test signal, use a spectrum analyzer on the downstream channel. The downstream carrier is enabled as a default.

The standard mode of operation is modulated signal output and the interface is active. For PRBS and continuous wave output, the selected interface will be shut down.

The functioning of the **no cable downstream if-output** command has not changed. The interface is shut down.

Pinging Unresponsive Cable Modems

Ping a Cable Modem

Ping DOCSIS is a Cisco patent-pending feature that allows a cable system administrator to quickly diagnose the health of a channel between the Cisco uBR7200 series universal broadband router and the cable modem. The technology uses 1/64—the bandwidth of IP ping—and works with cable modems that don't have an IP address. This allows cable operators to ping cable modems that are unable to complete registration, have internal bugs, or that are unresponsive due to a crash.

Information the Ping DOCSIS feature includes a real-time view and plot of requested power adjustments, as well as a measure of optimal headend reception power. This gives the cable operator the ability to solicit a configurable number of periodic ranging requests from a cable modem.

To ping a specific cable modem to determine if it is online, use the following command in EXEC mode.

Table 4-31 Instructions to Ping a Cable Modem

Command	Purpose
`CMTS01# ping docsis addr`	Ping the cable modem with a specific MAC address or IP address to see if it is online.

Verify the Ping

The **ping docsis** command returns a verification from a cable modem that is pinged:

```
Queueing 5 MAC-layer station maintenance intervals, timeout is 25 msec:
!!!!!
Success rate is 100 percent (5/5)
```

Tips If you are having trouble, make sure you are using a valid MAC or IP address for the cable modem you want to ping.

Using Cable Interface Debug Commands

To troubleshoot cable interfaces, use the following debug commands in enable (privileged EXEC) mode.

Table 4-32 Instructions to Use Debug Command

Command	Purpose
`CMTS01# debug cable ?`	View all debug cable commands that are available.
`CMTS01# undebug all`	Turn off all debugging information to the console and choose a more selective debug command. **Note** Refer to the debug commands that follow.

Caution The following commands can generate large amounts of output as the number of cable modems grows. On heavily loaded systems with thousands of cable modems, these commands can dramatically affect router performance.

Debug Cable ARP Requests

This command activates debugging of arp requests on the cable interfaces. When this command is activated, all cable arp request messages are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable arp
```

To deactivate debugging of arp requests, use the following command:

```
CMTS01# no debug cable arp
```

Debug Environmental Monitor Messages

This command activates debugging of the Cisco uBR7200 series environmental monitor. When this command is activated, all environmental monitor messages are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable envm
```

To deactivate debugging of the environmental monitor, use the following command:

```
CMTS01# no debug cable envm
```

Debug Cable MAC Protocol Errors

This command activates debugging of cable MAC protocol errors. When this command is activated, any errors that occur in the cable MAC protocol are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable err
```

To deactivate debugging of MAC protocol errors, use the following command:

```
CMTS01# no debug cable err
```

Activate Debug of Baseline Privacy

This command activates debugging of baseline privacy. The format for the command follows:

```
CMTS01# debug cable privacy
```

To deactivate debugging of baseline privacy, use the following command:

```
CMTS01# no debug cable privacy
```

Debug Baseline Privacy Activity

This command activates debugging of the tek and kek baseline privacy key activity. When this command is activated, all activity related to kek and tek keys is displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable keyman
```

To deactivate debugging of the keys, use the following command:

```
CMTS01# no debug cable keyman
```

Debug Cable MAC Messages

This command activates debugging of messages generated in the cable MAC that frames and encrypts downstream RF signals. When this command is activated, messages generated by the cable MAC are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable mac-messages
```

To deactivate debugging of cable MAC messages, use the following command:

```
CMTS01# no debug cable mac-messages
```

Debug Cable Maps

This command activates debugging of cable maps that identify data on cable interfaces. When this command is activated, messages related to cable maps are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable map
```

To deactivate debugging of cable maps, use the following command:

```
CMTS01# no debug cable map
```

Debug Cable Modems

This command activates debugging of cable modems. When this command is activated, messages from cable modems on the HFC network are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable modems
```

To deactivate debugging of cable MAC messages, use the following command:

```
CMTS01# no debug cable modems
```

Debug Cable PHY Messages

This command activates debugging of messages generated in the cable PHY—the physical layer where upstream and downstream activity between the Cisco uBR7200 series and the HFC network is controlled. When this command is activated, messages generated in the cable PHY are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable phy
```

To deactivate debugging of the cable PHY, use the following command:

```
CMTS01# no debug cable phy
```

Activate QoS Debug

This command activates debugging of QoS. When this command is activated, messages related to QoS parameters are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable qos
```

To deactivate debugging of QoS, use the following command:

```
CMTS01# no debug cable qos
```

Debug Cable Modem Ranging Messages

This command activates debugging of ranging messages from cable modems on the HFC network. When this command is activated, ranging messages generated when cable modems request or change their upstream frequencies are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable range
```

To deactivate debugging of cable modem ranging, use the following command:

```
CMTS01# no debug cable range
```

Debug Upstream Messages

This command activates debugging of upstream messages from cable modems. When this command is activated, any messages generated by cable modems and sent to the Cisco uBR7200 series will be displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable receive
```

To deactivate debugging of upstream messages, use the following command:

```
CMTS01# no debug cable receive
```

Debug Cable Modem Registration Requests

This command activates debugging of registration requests from cable modems on the HFC network. When this command is activated, messages generated by cable modems as they make requests to connect to the network are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable reg
```

To deactivate debugging of cable registration, use the following command:

```
CMTS01# no debug cable reg
```

Debug Cable Modem Reset Messages

This command activates debugging of reset messages from cable modems on the HFC network. When this command is activated, reset messages generated by cable modems are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable reset
```

To deactivate debugging of cable reset messages, use the following command:

```
CMTS01# no debug cable reset
```

Debug Spectrum Management

This command activates debugging of spectrum management (frequency agility) on the HFC network. When this command is activated, messages generated because of spectrum group activity are displayed on the Cisco uBR7200 series console. Spectrum group activity can be additions or changes to spectrum groups, or frequency and power level changes controlled by spectrum groups. The format for the command follows:

```
CMTS01# debug cable specmgmt
```

To deactivate debugging of cable spectrum management, use the **no debug cable specmgmt** command:

```
CMTS01# no debug cable specmgmt
```

Debug Channel Allocations

This command activates debugging of channel allocations on the HFC network. When this command is activated, messages generated when channels are allocated to cable modems on the HFC network are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable startalloc
```

To deactivate debugging of cable channel allocations, use the **no debug cable startalloc** command:

```
CMTS01# no debug cable startalloc
```

Debug CMTS Transmissions

This command activates debugging of transmissions from the Cisco uBR7200 series across the HFC network. When this command is activated, messages generated at the headend are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable transmit
```

To deactivate debugging of cable transmissions, use the **no debug cable transmit** command:

```
CMTS01# no debug cable transmit
```

Debug Upstream Channel Change (UCC) Messages

This command activates debugging of upstream channel change (UCC) messages generated when cable modems request or are assigned a new channel. When this command is activated, messages related to upstream channel changes are displayed on the Cisco uBR7200 series console. The format for the command follows:

```
CMTS01# debug cable ucc
```

To deactivate debugging of cable upstream channel changes, use the following command:

```
CMTS01# no debug cable ucc
```

Debug Upstream Channel Description (UCD) Messages

This command activates debugging of upstream channel descriptor (UCD) messages. UCD messages contain information about upstream channel characteristics and are sent to the cable modems on the HFC network. Cable modems that are configured to use enhanced upstream channels use these UCD messages to identify and select an enhanced upstream channel to use. When this command is activated, messages related to upstream channel descriptors are displayed on the Cisco uBR7200 series console. The format for the command is as follows:

```
CMTS01# debug cable ucd
```

To deactivate debugging of cable upstream channel descriptor, use the following command:

```
CMTS01# no debug cable ucd
```

Managing the Cisco uBR7246 VXR Clock Card

Cisco IOS Release 12.1(1a)T1 introduced clock card commands that included:

- **cable clock clear-counters**
- **cable clock force**
- **cable clock source-midplane**
- **show cable clock**
- **show controllers clock-reference**

Cisco IOS Release 12.1(1a)T1 modified commands to support clock card operation include:

- **show diag**
- **show frame-clocks**
- **show tech support**
- **show version**

Clear Clock Counters

To reset the counters that are displayed with the **show controllers clock-reference** command, use the **cable clock clear-counters** privileged EXEC command.

```
cable clock clear-counters
```

This command resets any counters that were displayed from the last time the **show controllers clock-reference** command was used.

Force Alternate Clock

To select the external timing source when the clock card is in holdover mode, use the **cable clock force** global configuration command. To disable the selection and return to the default, use the **no** form of this command.

cable clock force {**primary** | **secondary**}
no cable clock force

Setting the cable clock to *primary* forces the primary source to act as the clock reference. Setting the cable clock to *secondary* forces the secondary source to act as the clock reference.

The clock card automatically uses the primary external source, if available. If the primary source fails, the clock card enters holdover mode and after a few seconds, switches to the secondary external source. The clock card switches back to the primary source when it becomes available.

Note This command overrides the default behavior of the clock card, when the clock card is in holdover mode. If the clock card is not in holdover mode, this command is ignored. You cannot force the reference to a port if the clock card is in free-running mode. The clock card enters holdover mode if the forced reference is lost, even if the other external reference is available.

Set Midplane TDM Clock as Primary Reference

To make the midplane TDM clock the primary timing reference for the clock card, use the **cable clock source-midplane** global configuration command. To disable the selection and return to the default, use the **no** form of this command.

```
cable clock source-midplane
```

Note Because the clock card automatically provides the timing reference to the midplane TDM clock, the midplane cannot in turn act as the reference for the clock card. This means that the **cable clock source-midplane** command does not take effect unless a port adapter is configured as the primary clock reference source for the midplane.

Caution Although the **cable clock source-midplane** command is configurable, it is ignored, until a port adapter that can serve as the midplane clock reference source is supported in the Cisco uBR7246 VXR. Currently, there are no port adapters on the Cisco uBR7246 VXR that support this.

Display Clock Values

To display clock reference status information for the clock card, use the **show cable clock** privileged EXEC command:

```
show cable clock
```

The following sample output from the **show cable clock** command shows both external sources are available and the clock card is providing the clock reference:

```
Router# show cable clock
Clockcard primary input is present
Clockcard secondary input is present
Cable clock reference is clockcard primary input

Cable3/0 Timestamp clock reference is from Clockcard
Cable4/0 Timestamp clock reference is from Clockcard
```

Show Clock Hardware Information and Register Values

To display hardware information, register values, and current counters for the cable clock card, use the **show controllers clock-reference** privileged EXEC command.

```
show controllers clock-reference
```

Tips To reset the counters that are displayed with the **show controllers clock-reference** command, use the **Clear Clock Counters** command.

The following is sample output from the **show controllers clock-reference** command:

```
Router# show controllers clock-reference
National clock card with T1 controller
Control register     :0x4
Status register      :0x54
LIU Config Register 0:0x0
LIU Config Register 1:0x0
1 events reported in 266636 seconds
Primary active :1, LOS :0
Secondary active :0, LOS :1
Holdovers :0, HW faults :0
```

Show Clock Diagnostic Information

To display diagnostic information for the cable modem cards, use the **show diag** command in privileged EXEC mode.

Tips Use the **show diag** command to display diagnostic information about the port adapters installed in the router. This command also displays information about the cable clock card, if installed.

The following is sample output from the **show diag** command displaying diagnostic information for the cable clock card:

```
router# show diag
Clockcard:
National clock card with T1 controller
EEPROM contents at hardware discovery:
Hardware Revision        :1.1
Part Number              :800-05867-02
Board Revision           :11
Deviation Number         :0-0
Fab Version              :02
PCB Serial Number        :CAB04046NXV
RMA Test History         :00
RMA Number               :0-0-0-0
RMA History              :00
EEPROM format version 4
EEPROM contents (hex):
  0x00:04 FF 40 01 AC 41 01 01 C0 46 03 20 00 16 EB 02
  0x10:42 31 31 80 00 00 00 00 02 02 C1 8B 43 41 42 30
  0x20:34 30 34 36 4E 58 56 03 00 81 00 00 00 00 04 00
```

Table 4-33 describes the fields shown in the **show diag** display.

Table 4-33 Show Diag Parameter Descriptions

Field	Description
National clock card with T1 controller	The system has identified the cable clock card.
EEPROM contents at hardware discovery	EEPROM programmed data present when the system identified the clock card.
Hardware Revision	Version number of the card.
Part Number	The part number of the card.
Board Revision	Revision number (signifying a minor revision) of the card.
Deviation Number	Revision number (signifying a minor deviation) of the card.
Fab Version	Manufacturing fabrication version number.
PCB Serial Number	Serial number of the printed circuit board.
RMA Test History	Counter indicating how many times diagnostics have been performed on this card.
RMA Number	Return material authorization number, which is an administrative number assigned if the card needs to be returned for repair.
RMA History	Counter indicating how many times the card has been returned and repaired.
EEPROM format version	Version number of the EEPROM format.
EEPROM contents (hex)	Dumps of EEPROM programmed data.

Show Clock Frames

To display information about the midplane TDM clock reference, use the **show frame-clocks** privileged EXEC command.

show frame-clocks

The following sample output from the **show frame-clocks** command shows that there are no clock sources configured and the clock card is the default clock source:

```
Router# show frame-clocks
Priority 1 clock source:not configured input:none
Priority 2 clock source:not configured input:none
Priority 3 clock source:not configured input:none
Priority 4 clock source:not configured input:none
Current clock source:Clockcard, input:Primary, priority:5
```

Table 4-34 describes the fields shown in the **show frame-clocks** display:

Table 4-34 Show Frame-clocks Parameter Descriptions

Field	Description
Priority 1-4 clock source	The configuration of the four network clock sources.
Current clock source	The current clock source, its input, and priority. In this example, the clock card is providing the clock source.

Show General Information

To display general information about the router when reporting a problem, use the **show tech-support** privileged EXEC command.

show tech-support *[page] [<password>]*

The *page* option causes the output to display a page of information at a time. Use the **Return** key to display the next line of output or use the space bar to display the next page of information. If not used, the output scrolls (that is, does not stop for page breaks).

The *password* option leaves passwords and other security information in the output. If not used, passwords and other security-sensitive information in the output are replaced with the label "<removed>" (this is the default).

Use this command to help collect general information about the router when you are reporting a problem. This command displays the equivalent of the following show commands:

- **show buffers**
- **show controllers**
- **show interfaces**
- **show running-config**
- **show processes cpu**
- **show processes memory**
- **show stacks**
- **show version**